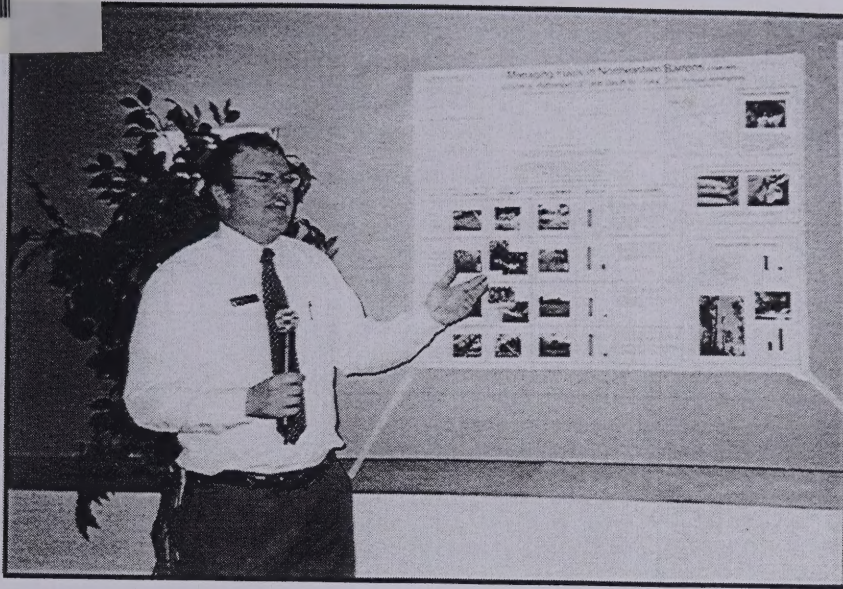


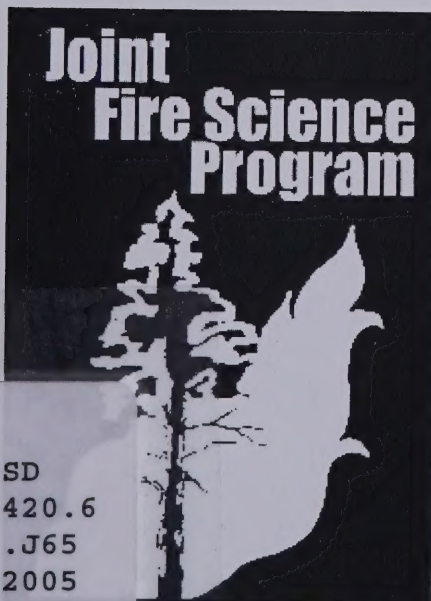
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2005 Principal Investigator Workshop



November 1-3, 2005

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JFSP Governing Board



From Left: Lee Barkow, Paul Langowski, Peg Boland, Sue Conard, Nate Benson, Jan van Wagendonk, Sue Grace, Beverly Schwab, Tim Sexton, John Laurence

Joint Fire Science Program

Principal Investigator Workshop

ORAL PRESENTATIONS

November 1-3, 2005

Tuesday, November 1, 2005

Moderator: Stan Coloff

7:00 - 8:00 AM	Registration	
8:00 AM	Housekeeping	Becky Jenison - JFSP
8:15 AM	Welcome/Opening Remarks	Erik Berg -JFSP
8:30 AM	Contracting Issues	Sherry Garey - BLM NIFC
8:45 AM	USFS Funding	John Sebelius - USFS, WO
9:00 - 9:15 AM	BREAK	

Planning and Preparedness

9:15 AM	Modeling Vegetation Phenology for the Assessment of Present and Future Fire Hazard Potential	Matt Jolly - USFS, RMRS
9:30 AM	Fire-Climate Interactions and Predicting Fire Season Severity in the Mediterranean Climate Areas of California, Southern Oregon, and Western Nevada	Carl Skinner - USFS, PSW
9:45 AM	Monitoring Trust as an Evaluation of the Success of Collaborative Planning in a Landscape-Level Fuel Hazard Reduction Treatment Project in the Bitterroot Valley, Montana	Alan Watson - USFS Aldo Leopold Wilderness Research Institute
10:00 AM	Evaluation of Post-Wildfire Debris Flow Mitigation Methods and Development of Decision-Support Tools	Paul Santi - Colorado School of Mines
10:15 - 10:30 AM	BREAK	
10:30 AM	Decision Support Methods for Prescribed Fire	Don MacGregor - MacGregor-Bates, Inc.
10:45 AM	Characterization of Firefighter Safety Zone Awareness	Bret Butler - USFS, RMRS
11:00 AM	Developing an Analysis and Planning Framework for District-Level Fuels Treatments Projects.	Alan Ager - USFS, Umatilla NF
11:15 - 11:45 AM	DISCUSSION	
11:45 - 1:00	LUNCH	

Remote Sensing

1:00 PM	Fuel Classification for the Southern Appalachian Mountains using Hyperspectral Image Analysis and Landscape Ecosystem Classification	Thomas Waldrop - USFS, SRS
1:15 PM	Advanced Remote Sensing Technologies for Monitoring Postburn Vegetation Trends and Conditions	Raymond Kokaly - USFS, NCRS

1:30 PM	Mapping Horizontal and Vertical Distribution of Fuel by Fusing High-Resolution Hyperspectral and Polarimetric Data	Don Despain - USGS, Northern Rocky Mountain Science Center
1:45 PM	Evaluating High Resolution Hyperspectral Images for Determining Postfire Burn Severity	Peter Robichaud - USFS, RMRS
2:00 PM	Using LIDAR to Identify Sediment and Forest Structure Change in the Hayman Burn, Colorado	Merrill Kaufmann - USFS, RMRS
2:15 PM	Demonstration and Integration of Systems for Fire Remote Sensing, Ground Based Fire Measurement, and Fire Modeling	Colin Hardy - USFS, RMRS
2:30 - 2:45 PM	DISCUSSION	
2:45 -3:15 PM	BREAK	

Air Quality, Smoke Management, and Climate

3:15 PM	Climatic Controls of Fire in the Western United States: From Atmospheres to Ecosystems	Steven Hostetler - USGS
3:30 PM	Atmospheric Fire Risk in a Changed Climate	Julie Winkler - Michigan State University
3:45 PM	Forecasting of Fire Weather and Smoke Using Vegetation-Atmosphere Interactions	Karl Zeller - USFS, RMRS
4:00 PM	An Automated System for Evaluating BlueSky Predictions of Smoke Impacts on Community Health and Ecosystems	Susan O'Neill - USFS, PNW
4:15 - 4:30 PM	DISCUSSION	
5:30-7:30 PM	Social/Poster/Awards	

Wednesday, November 2, 2005

Moderator: David Van Lear

Fire Effects and Fuels Treatment Effects

8:00 AM	Carbon Cycling at the Landscape Scale: the Effect of Changes in Climate and Fire Frequency on Age Distribution, Stand Structure, and Net Ecosystem Production	Michael Ryan - USFS, RMRS
8:15 AM	Prescribed Fire Strategies to Restore Wildlife Habitat in Ponderosa Pine Forests of the Intermountain West	Vicki Saab - USFS, RMRS
8:30 AM	Fuel Consumption and Flammability Thresholds in Shrub-Dominated Ecosystems	Clinton Wright - USFS, PNW
8:45 AM	Characterization in Boreal Forested Fuelbed Types of Alaska	Roger Ottmar - USFS, PNW
9:00 AM	Patch Burning on Grasslands: Effects on Fuels, Fire Behavior, and Fire Spread	Jay Kerby - Iowa State Univ.
9:15 AM-9:30	DISCUSSION	
9:30 -10:00	BREAK	

Fire and Invasive Species

3:45 PM	Spatial Interactions Among Fuels, Wildfire, and Invasive Plants	Erik Martinson - Colorado State University
4:00 PM	Fire and Invasive Annual Grasses in Western Ecosystems	Matthew Brooks - USGS
4:15 PM	Invasive Plant and Fire Interactions: Use of the Fire Effects Information System to Provide Information for Managers	Kevin Ryan - USFS, RMRS
4:30 - 4:45 PM	DISCUSSION	

Thursday, November 3, 2005

Moderator: Carol Miller

8:00 - 9:00 AM	Rapid Response Panel: Lessons Learned, Planning and Logistics Considerations of Rapid Response Projects	Moderator: John Szymoniak - USFS
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Social and Economic Impacts

9:00 AM	Evaluating Communication Strategies and Local Partnerships: Methods for Reducing Fuels, Sharing Responsibility and Building Trust	Bruce Shindler - Oregon State University
9:15 AM	In-woods Decision Making of Utilization Opportunities to Lower Costs of Fire Hazard Reduction Treatments	Eini Lowell - USFS, PNW
9:30 AM	A National Study of the Economic Impacts of Biomass Removals to Mitigate Wildfire Damages on Federal, State, and Private Lands	Jeffrey Prestemon - USFS, SRS
9:45 AM	A Social Assessment of Public Knowledge, Attitudes and Values Related to Wildland Fire, Fire Risk, and Fire Recovery	J. M. Bowker - USFS, SRS
10:00 AM	Impacts of Prescribed Burning on the Survival of Douglas-fir and Ponderosa Pine in the Boise National Forest	Robert Progar - USFS, PNW
10:15 - 10:45	DISCUSSION	
10:45 - 11:15	BREAK	
11:15-11:45	Rapid Response for Decision Support - Wildland Fires 2005	John Szymoniak - USFS Bret Butler - USFS, RMRS Mark Finney - USFS, RMRS
11:45-1:00 PM	LUNCH	

Demonstration Sites, Admin. Sites, Local Needs

1:00 PM	Determining the Ecological Effects of Fire Suppression, Fuels Treatment, and Wildfire through Bird Monitoring in the Klamath Ecoregion of Southern Oregon and Northern California	John Alexander - Klamath Bird Observatory
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Joint Fire Science Program	
Principal Investigator Workshop	
Poster Session	
November 1-3, 2005	
A National Study of the Consequences of Fire and Fire Surrogate Treatments	Jim McIver - USFS, PNW
A Novel Approach to Regional Fuel Mapping: Linking Inventory Plots with Satellite Imagery and GIS Databases Using the Gradient Nearest Neighbor Method	Janet Ohmann - USFS, PNW
Armells Creek Prescribed Fire Demonstration Project	Clayton Marlow - Montana State University
Automated Forecasting of Smoke Dispersion and Air Quality Using NASA Terra and Aqua Satellite Data	Wei Min Hao - USFS, RMRS
Can Wildland Fire Use Restore Historical Fire Regimes in Wilderness and Other Unroaded Lands?	Carol Miller - USFS, RMRS
Consequences and Correlates of Fire in Wetlands	David Brownlie - USFWS
Demonstrating the Ecological Effects of Mechanical Thinning and Prescribed Fire on Mixed-Conifer Forests	Malcolm North - USFS, PSW
Developing Statistical Wildlife Habitat Relationships For Assessing Cumulative Effects of Fuels Treatments	Kevin McKelvey - USFS, RMRS
Development of a Computer Model for Management of Fuels, Human-Fire Interactions, and Wildland Fires in the Boreal Forest of Alaska	Scott Rupp - University of Alaska
Effects of Fire on Biological Soil Crusts and Their Subsequent Recovery at the Great Basin Pinyon-Juniper Demonstration Area	Steven Warren - Colorado State University
Effects of Fuels Treatments on Native Flora and Fauna: Restoration in Weed-Invaded Landscapes of the Northern Rocky Mountains	Yvette Ortega - USFS, RMRS
Effects of Mechanically Generated Slash Particle Size on Prescribed Fire Behavior and Subsequent Vegetation Effects	Richy Harrod - USFS, Okanogan-Wenatchee National Forest
Effects of Prescribed and Wildland Fire on Aquatic Ecosystems in Western Forests	David Pilliod - USFS, RMRS
Effects of Prescribed Burning on Mycorrhizal Fungi in Crater Lake National Park	Randolph Molina - USFS, PNW

Evaluate Sensitivities of Burn-Severity Mapping Algorithms for Different Ecosystems and Fire Histories in the United States	Zhiliang Zhu - USGS
Fire and Fuels Extension to the Forest Vegetation Simulator: Completion of Calibration for Eastern Forests, Provisions for User Training, and Program Maintenance	Stephanie Rebain - USFS, Forest Management Service Center
Fire Effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River	Courtney Conway - USGS
Fire Regimes and Forest Structure of Utah and Eastern Nevada: A Multi-scale History from Tree Rings	Emily Heyerdahl - USFS, RMRS
Fire Regimes and Successional Dynamics of Yellow Pine (Pinus) Stands in the Central Appalachian Mountains	Henri Grissino-Mayer - University of Tennessee Charles Lafon - Texas A&M Univ.
Fire Regimes of Forests in the Peninsular and Transverse Ranges of Southern California	Scott Stephens - University of California, Berkeley
Frequency and Season of Prescription Fires to Reduce Hazardous Fuel Loads on the Lower Piedmont of Georgia: Establishing a Demonstration Area on a 12 year-old Study	Kenneth Outcalt - USFS, SRS
Fuel Reduction Effects on a Key Sierra Food Web	Malcolm North - USFS, PSW
Incorporating Spatial Heterogeneity into Fire Restoration Plans	Dean Urban - Duke University
Integrating Fuel and Forest Management: Developing Prescriptions for the Central Hardwood Region	Edward Loewenstein - Auburn University
Landscape Fragmentation and Forest Fuel Accumulation: Effects of Fragment Size, Age, and Climate	William Gould - USFS, International Institute of Tropical Forestry
Maintaining Longleaf Pine Woodlands: Is Mechanical Shearing a Surrogate for Prescribed Burning	Jeff Glitzenstein - Tall Timbers Research Station
Optimizing Landscape Treatments for Reducing Wildfire Risk and Improving Ecological Sustainability of Ponderosa Pine Forests within Mixed Severity Fire Regimes	Merrill Kaufmann - USFS, RMRS

Predicting Lightning Risk	Miriam Rorig - USFS, PNW
Pre-Fire Fuel Manipulation Impacts on Alien Plant Invasion of Wildlands	Jon Keeley - USGS
Prescribed Fire for Fuel Reduction in Northern Mixed Grass Prairie: Influence on Habitat and Population Dynamics of Indigenous Wildlife	Robert Murphy - USFWS
Quantitative Comparison of Spectral Indices and Transformations with Multi-resolution Remotely Sensed Data Using Ground Measurements: Implications for Fire Severity Modeling	Jennifer Rechel - USFS, PSW
Restoration of Dry, Montane Meadows Through Prescribed Fire, Vegetation, and Fuels Management: A Program of Research and Adaptive Management in Western Oregon	Fred Swanson - USFS, PNW
The Effects of Prescribed Fire Season and Fire Surrogates on Crown Fire Adapted Knob Cone Pine Forests	James Dawson - BLM
Tree Regeneration Response to Fire Restoration in Mixed-Conifer Forest	Andrew Gray - USFS, PNW
Evaluation of three Fuel Management Treatments for Eastern White Pine	James Cook - Univ. of Wisconsin at Stevens Point
Fire and Oak Regeneration in the Southern Appalachians	David Loftis - USFS, SRS
Effects of Prescribed Fire on the Invasion of Northern Mixed-grass Prairie by Non-Native Plant Species	Fred Geise - USFWS
Effects of Disturbance History, Landscape Pattern, and Weather on Wildfire Severity in Southwestern Oregon	Thomas Spies - USFS, PNW
Effects of Prescribed Burning, Mechanical, and Chemical Treatments to Curtail Rhododendron Dominance	Shep Zedaker - Virginia Polytechnic Univ.
Duff Consumption and Southern Pine Mortality	John Hiers - USAF, Eglin Air Force Base
Fire Use over a Southwestern Elevational Gradient: Effects of 2003 Fires	Pete Fule - Northern Arizona Univ.
A Web-Based Information System for Estimating Fuel Characteristics, Fire-Hazard, and Treatment Effectiveness and Costs in Montana and New Mexico	Carl Fiedler - Univ. of Montana
Development and Demonstration of Smoke Plume, Fire Emissions, and Pre- and Post- Prescribed Fire Fuel Models on North Carolina Coastal Plaine Forest Ecosystems	Robert Mickler - ManTeck Environmental Technology Inc.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Modeling vegetation phenology for the assessment of present and future fire hazard potential

JFSP Project No.: 03-1-1-08

Project Location: USDA FS, RMRS, Fire Sciences Laboratory, Missoula, MT

Principal Investigators: Matt Jolly, USDA FS, RMRS, Fire Sciences Laboratory
Pat Andrews, USDA FS, RMRS, Fire Sciences Laboratory

Contact Information (Phone, e-mail):

Jolly: mjolly@fs.fed.us; 406-329-4848; fax 406-329-4825

Andrews: pandrews@fs.fed.us; 406-329-4827; fax 406-329-4825

Brief Description of Project: We will develop a greenness monitor and model whose results are suitable for integration into the National Fire Danger Rating System (NFDRS). The system will combine both satellite-derived vegetation indices and spatially continuous estimates of key weather variables to predict the greenness date of vegetation over the continental United States, Alaska and Hawaii. The greenness monitor will predict greenness conditions with weather data alone and will allow us to forecast greenness conditions when appropriate predicted weather variables are available. We will implement this weather driven greenness model into the NFDRS and drive it with data from a global circulation model (GCM) to assess the changes in fire potential in the US as a result of climate change.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Major Accomplishments:

- Completed the development of a greenness monitoring system that integrates gridded surface weather data with a generalized phenology model. This system operates unattended each day and produces greenness estimates continuously across the continental United States and Alaska. This system can be used to obtain a recommended greenup date for use in NFDRS and later will be extended to provide greenness factors for use in the 1988 version of NFDRS.
- Created a website that distributes the data in both point and spatial formats. The website provides a user interface that allows extraction and real-time graphing of greenness estimates for a point. It also provides access to time series of AVHRR NDVI-derived products that are currently part of the Wildland Fire Assessment System (WFAS).
- Developed customized interfaces for two Geographic Area Coordination Centers (GACCs). These fire managers are using this product on a regular basis to assess greenness conditions throughout their management area.
- Developed a system to automatically retrieve and process MODIS satellite data for use in verifying weather-driven point models. These data will be integrated in the greenness monitoring system along with current AVHRR products to provide users with multiple independent greenness assessments.

Publications:

Jolly, W. M., M. Dobbertin, M. Reichstein, and N. Zimmermann. In Press. Divergent vegetation growth responses to the 2003 heat wave in the Swiss Alps. *Geophysical Research Letters*.

Jolly, W. M., J. M. Graham, A. Michaelis, R. Nemani, and S. W. Running. 2005a. A flexible, integrated system for generating meteorological surfaces derived from point sources across multiple geographic scales. *Environmental Modelling & Software* **20**:873-882.

Jolly, W. M., R. R. Nemani, and S. W. Running. 2005b. A generalized, bioclimatic index to predict foliar phenology in response to climate. *Global Change Biology* **11**:619-632.

Presentations:

"A generalized, bioclimatic index to predict foliar phenology in response to climate". American Geophysical Union Fall Meeting. Dec.,

"A mechanistic, weather-driven greenness model for the National Fire Danger Rating System". National Predictive Services Group, Annual Meeting.

Invited Talk: "A mechanistic, weather-driven greenness model for the National Fire Danger Rating System". Southern Area Fire Danger / Fire Weather Working Team Fall Meeting.

"A mechanistic, weather-driven greenness model for the US National Fire Danger Rating System (NFDRS). EastFire meeting.

Issues/Concerns; changes in research objectives, methods, or products:

No concerns.

JFSP 2005 Principal Investigator Workshop

Project Title: Fire-climate interactions and predicting fire season severity in the Mediterranean climate areas of California, Southern Oregon, and Western Nevada

JFSP Project No.: 03-1-1-22

Project Location: Federal Lands in California, southern Oregon, and western Nevada. PVT timber lands in northern California.

Principal Investigators: C.N. Skinner, A.H. Taylor, A.M. Carleton, S.L. Stephens, W. Herzog, J.H. Perkins, J. Karish

Contact Information (Phone, e-mail): Skinner (530 226-2554, cskinner@fs.fed.us), Taylor (814 865-3433, ah1@psu.edu)

Description of Project: The goal of this project is to identify the relationships between interannual and interdecadal climate variation and multi-decadal and multi-century climate change on sub-regional variation in montane forest fire regimes in the Mediterranean Climate Area (MCA) of the Pacific Coast. Specific objectives are to: 1) determine how the dominant modes of climatic circulation are related to surface fire weather, secondary circulation features, and spatial and temporal variation in 20th century fire extent; 2) determine how multi-century records of fire extent, climate variability, climate change, dominant circulation modes, and fire danger indices vary within the MCA; 3) identify the key variables associated with circulation modes that can be used for spatially explicit prediction of problematic fire seasons in different parts of the MCA months to years in advance.

Status Report:

- Spatially explicit data have been acquired to develop databases needed to link 20th century fire patterns in the MCA to contemporary climate. The following information has been compiled for the project area: 1) fire perimeter data (for the period ca. 1914 - 2002), and 2) meteorological station data (WRCC). These data are being organized and processed for their use in subsequent analysis. This has involved converting data formats, creating annual and seasonal average time-series of temperature and precipitation, and identifying potential areas for compositing of climate data to create regional averages. The regional averages will be used later for developing climate response functions from tree-rings for determining presettlement fire-climate relationships.
- We have field sampled a total of 33 fire-scar data sites: Sierra National Forest (10), Sequoia National Forest (3), Yosemite National Park (part of another study) (2), Mendocino National Forest (5), Klamath National Forest (1), Siskiyou National Forest (4), Sierra Pacific, Inc lands in N. California (4), Tahoe National Forest (2), Shasta-Trinity National Forests (2). These data will be added to existing data from the Klamath Mountains, Cascade Range, Sierra Nevada, Transverse Range, and Peninsular Ranges to make up the spatial data array of pre-suppression fire patterns.
- A 'pilot' analysis of presettlement period fire-climate interactions was completed for Jeffrey pine forests in the northern Sierra Nevada focusing on the Lake Tahoe Basin was published in 2005. *Taylor, A.H. and R.M. Beaty. Climatic influences on fire regimes in the northern Sierra Nevada, Lake Tahoe, Nevada, USA. Journal of Biogeography 32: 425-438.*

- A similar analysis of fire-climate interactions focusing on the Sierra San Pedro Martir (where fire suppression has only recently begun) has been completed and will be submitted for publication in late 2005. These pilot projects will serve as starting points for planned analyses of presettlement fire-climate interactions throughout the MCA.
- Invited talks and seminars – 4.
- Offered papers at professional meetings - 4
- M. S. Thesis – 1: *Smith, R., Relationships between climate and forest fire patterns in the U.S. west coast states, M.S. Thesis, Department of Geography, The Pennsylvania State University.*

Issues/Concerns affecting the project: The project was scheduled to begin May 1, 2003. However, the task order was not received until after the beginning of FY2004. Cooperative agreements between PSW, Penn State, and U.C. Berkeley have been completed.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Decision Support Methods for Prescribed Fire

JFSP Project No.: 01-1-7-14

Project Location: Eugene, OR (MacGregor), & Fort Collins, CO (Sapio)

Principal Investigators: Donald G. MacGregor (PI) & Frank Sapio (Co-PI)

Contact Information (Phone, e-mail): (541) 942-5727, donalddm@epud.net

Brief Description of Project: This project focuses on the development of a model for prescribed fire decision support that uses decision science principles to represent fuel management program design in terms of strategic alternatives and contingencies. The model is based on the architecture of the Wildland Fire Situation Analysis (WFSA) used in wildland fire decision support, and which uses decision analysis and multi-attribute utility analysis (MAU) to provide a framework for problem structuring, specification of objectives, definition of measurement, and value tradeoffs.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

This is a three-year project with an additional one-year extension, ending October 31, 2005. All phases of the project are completed and a final report is in preparation. The results of the project demonstrate the feasibility of using a decision analysis and MAU architecture to model strategic decisions in fuels program design. The final products of the project are:

- a conceptual framework for fuels program strategic evaluation,
- a software prototype that demonstrates the approach,
- a workshop approach to training field staff in decision science principles relevant to strategic decision making, and
- a set of recommendations for technology transfer, based on field experience with interagency fire personnel.

Issues/Concerns; changes in research objectives, methods, or products:

No critical issues or concerns affect the project at this time.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Characterization of Firefighter Safety Zone Effectiveness

JFSP Project No.: 03-2-1-03

Project Location: Missoula, MT

Principal Investigators: Bret Butler

Contact Information (Phone, e-mail): 406-329-4801, bwbutler@fs.fed.us

Brief Description of Project:

This proposal outlines a research effort to assemble, equip and deploy a team to obtain measurements of energy transfer as naturally burning fires burn into and around clearings that may be characterized as firefighter safety zones. The primary outcome of this effort will be an evaluation a firefighter safety zone model that is being widely used in firefighter training. Past research resulted in the development of a theoretical model for quantifying firefighter safety zones (Butler and Cohen, 1998). Since then some efforts have resulted in a few data points that can be used to "validate" the model. The few measured data and some anecdotal evidence suggest that the model is "in the ball park" but it remains unproven from a quantitative standpoint. Fire intensity information is needed for evaluation of the safety zone model. An additional factor is that the firefighter safety zone model addresses only radiant energy transfer it does not account for convective heating.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

In 2003 the team deployed to Arizona and participated in prescribed fire efforts on the Tonto National Forest. Measurements of radiant and convective energy flux from the fire, vertical and horizontal air speeds and temperatures were collected. These data were used to further test the theoretical model for firefighter safety zones. A second set of measurements were collected in on a wildfire in the Malheur National Forest outside of Unity, Oregon. Again these data were used to test the firefighter safety zone model. A third deployment was conducted on the Cooney Ridge Fire burning on the Lolo National Forest east of Missoula, Montana. No deployments occurred in 2004. During 2004 detailed information about firefighter safety zones was provided to the team revising the S-390 course. This information was used in the development of the new course. During 2005, the instruments were deployed on the I-90 complex wildfire burning west of Missoula, Montana. Work continues to develop new understanding into the factors that affect convective energy transfer and its impact on firefighter safety zones.

Issues/Concerns; changes in research objectives, methods, or products:

No specific concerns are presented. The PI has requested and received approval to extend the project an additional 8 months to permit deployment during 2005. The PI will apply for additional support to further explore the effect of convective heating on firefighter safety zones. This is especially critical when considering safety zones in mountainous terrain.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Developing an Analysis and Planning Framework For District-Level Fuels Treatment Planning

JFSP Project No.: JFSP 03-4-1-04

Project Location: PNW Research Station, La Grande Forestry and Range Sciences Lab.

Principal Investigators: Alan Ager, Bob McGaughey

**Contact Information (Phone, e-mail): aager@fs.fed.us, 541/278-3740,
mcgoy@u.washington.edu, 206/543-4713**

Brief Description of Project:

This study is concerned with developing an integrated framework of vegetation and wildfire behavior models to streamline the analysis and design of forest restoration and fuels treatment projects. The target is primarily resource planners that use fire behavior models to develop and analyze fuels treatment scenarios. A secondary objective is to apply the models to examine the long-term feasibility of forest restoration proposals in the Blue Mountains of eastern Oregon.

Status Report:

- A number of widely-used models for fuels treatment planning were integrated into desktop ArcGIS ("ArcFuels").
- The software was tested on several study areas. We modeled a range of fuel treatment scenarios over time and examined the response with several wildfire behavior models.
- The project picked up several collaborators that are interested in testing and refining the initial version. Distribution is planned for late 2005. Collaborators include private GIS consultants, specialists from the BLM and USFS.
- Software demonstrations and posters were presented at a number of local, regional, and national meetings. Abstracts were published at 8 professional meetings.
- The software and applications have been described in four papers; two proceedings papers are in press, and two journal papers have been submitted. An additional journal paper is receiving internal review.
- A preliminary website describing the project was constructed (<http://www.fs.fed.us/r6/uma/projects/research/>)
- Additional technology transfer components, including a user's manual and proceedings papers are anticipated.

Issues/Concerns; changes in research objectives, methods, or products:

None.

JFSP 2005 Principal Investigator Workshop

Project Title: Fuel Classification for the Southern Appalachian Mountains using Hyperspectral Image Analysis and Landscape Ecosystem Classification

JFSP Project No.: 01-1-4-02

Project Location: Sumter National Forest, SC; Chattahoochee National Forest, GA; Nantahala National Forest, NC; and Great Smoky Mountains National Park, TN.

Principal Investigators: Thomas A. Waldrop

Contact Information (Phone, e-mail): (864) 656-5054, twaldrop@fs.fed.us

Description of Project: Excessive fuel loading and rapid urbanization are of concern throughout the southern Appalachian Mountains. Prescribed burning has been attempted only recently in these mountains and fuel models are not available. This project will use a two-phase approach to model fuel loading in the region. The first phase will be to develop a classification of fuels using ground measurements and an existing Landscape Ecosystem Classification system to define fuel categories. We expect fuel classes to be correlated with the same variables used to define landscape units (geography and topography). Once this classification is developed, the second phase of this project will be to determine if fuels in each class can be detected from aerial images using hyperspectral image analysis. Signatures of reflectance values will be developed for each fuel category with ground measurements. Analysis of hyperspectral images will identify areas on the ground containing each category of fuel loading. Ground crews will verify the accuracy of these signatures and improvements will be made as needed. Validation of the signatures will be done by image analysis and ground truthing for an area away from those used to develop the signatures. Resulting signatures will greatly reduce the cost of mapping fuels throughout the southern Appalachians because analysis of hyperspectral images will be less complex.

Status Report: The project includes 4 study areas, one each in SC, GA, NC, and TN. Each site is a 10-square mile mountainous area, selected in consultation with local fire management officers. A set of 250 study plots was selected in each study area using stratified random sampling. Equal numbers of plots were selected on ridgetops, at midslope on north- and south-facing slopes, and on lower slope positions on north- and south-facing slopes. During 2003, all points in the SC and GA sites were sampled. Sampling was completed for sites in NC and TN during 2004 and 2005. Measurement variables include species and density of the tree, shrub, and ground layers and loading of woody fuels. Hyperspectral images were made during flights prior to and after leaf fall. Ortho-registration of the imagery is currently under way. The hyperspectral data is being spectrally normalized. We are also screening the data for "spectrally pure" pixels, a necessary step in deriving clean signatures of our Materials of Interest (MOI). Analysis of field data and images is underway. Preliminary results were presented at the 13th Biennial Southern Silvicultural Research Conference describing methods for developing fuel models in the Appalachians and a preliminary hardwood fuel model.

Issues/Concerns affecting the project: The project began slowly due to high turnover of personnel in key positions. That problem has been resolved and significant progress has been made since September 2003. Field sampling in the Great Smoky Mountains National Park is much slower than on National Forest sites because the study site is in a proposed wilderness area. Access is very limited, requiring hikes of up to 10 miles to reach sample points. Therefore, 25 of the most remote sample points will not be measured. The final sample contains 975 plots instead of 1,000 as originally planned.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Advanced Remote Sensing Technologies for Monitoring Postburn Vegetation Trends and Conditions

JFSP Project No.: 01-1-4-14

Project Location: Left Hand Creek, Wyoming, and Sheldon National Wildlife Refuge, Nevada.

Principal Investigators and Contact Information:

Susan Goodman, Bureau of Land Management, National Science and Technology Center, Box 25047, Denver Federal Center, Denver, CO 80225, Phone: (303) 236-4242, E-mail: susan_goodman@blm.gov

Raymond Kokaly, U.S. Geological Survey, Spectroscopy Laboratory, Denver, CO 80225 Phone: (303) 236-1359, E-mail: raymond@usgs.gov

Melinda McGann, U.S. Forest Service, Rocky Mountain Region, 740 Simms St.; Golden, CO 80401, Phone: (303)275-5211, E-mail: mlmcgann@fs.fed.us

Amanda G. McAdams, U.S. Forest Service, Dixie and Fishlake National Forests, P.O. Box 80, Panguitch, UT 84759, Phone: (435) 676-9300

Brief Description of Project: This project seeks to employ several types of state-of-the-art remote sensing technologies (1) for accurately mapping post-fire plant community associations over time in order to evaluate outcomes of prescribed fire, and (2) for developing a capability, driven by imaging spectroscopy, to remotely estimate chlorophyll and moisture content of grassland and shrub fuel types for the purpose of enhancing inputs for fire behavior modeling.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

These aspects of the project have been completed:

- All field data related to the project have been collected and compiled into a spatial geodatabase.
- All remote sensing data related to the project have been collected and converted to reflectance.
- Field spectra linked to post-fire vegetation inventories have been compiled into a spectral library database and are being released as a U.S. Geological Open File Report.
- Computer algorithms to map vegetation composition in sagebrush/grassland areas have been developed.
- Laboratory methods to quantify plant water content and chlorophyll content have been successfully developed and tested.
- The project website has been created.

These aspects of the project are underway:

- Data are being analyzed to relate vegetation composition in burned and unburned areas to field measured reflectance spectra and remotely sensed spectra.
- Vegetation species composition data in unburned, prescribed fire and wildland fire plots are being compared.
- Hyperspectral remote sensing data and high-resolution remote sensing data are being interpreted to map to determine the effects of prescribed fire and wildland fire on sagebrush ecosystems.
- A summary publication for a peer-reviewed journal is being prepared.

Issues/Concerns; changes in research objectives, methods, or products:

A no-cost extension of the project was requested and granted. As stated in that agreement, the computer algorithms used to analyze field spectra and hyperspectral remote sensing data will be published and released to the public.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Using LIDAR to Identify Sediment and Forest Structure Change in the Hayman Fire, Colorado

JFSP Project No.: 03-2-3-18

Project Location: Colorado Front Range

Principal Investigators: Merrill Kaufmann, Jason Stoker

Contact Information (Phone, e-mail): 970-498-1256, mkaufmann@fs.fed.us

Brief Description of Project:

A LIDAR acquisition prior to the Hayman fire provided researchers an opportunity to determine the effectiveness of using LIDAR to quantify sediment and vegetation change due to the 2002 Hayman fire and associated post-fire erosion. The purpose of this research was to determine if pre- and post-fire LIDAR was an effective method of quantifying sedimentation change and vegetation change due to the fire.

Status Report:

- Research has yielded interesting results, however not what was hypothesized. It appears that differences in pre- and post-fire LIDAR data are caused by different flight paths and trajectories taken with the LIDAR sensor and by a change in sensors. These differences resulted in higher than expected errors between the two datasets.
- While large changes in local topography were readily detected (e.g. piling of post-fire sediment excavated from a major drainage), the smaller changes in microsite elevation associated with local erosion or deposition could not be detected.
- We have determined that there are increasing errors associated with increasing slope gradients. These errors cause interference in detecting statistically significant bare earth change between the pre- and post-fire datasets.
- This study suggests an important lesson for the use of replicated LIDAR datasets for change detection. Flight paths must be repeated as close as possible in complementary flights to reduce the amount of error introduced from slope conditions.
- Vegetation change has been similarly affected, but detecting the absence of needle-bearing trees (in this case by fire) shows promise in using LIDAR for assessing changes in vegetative structure.

Issues/Concerns; changes in research objectives, methods, or products:

- We are summarizing results and are preparing a publication intended to assist scientists and managers attempting LIDAR change detection so they can avoid similar confounding results.
- We are attempting to find a statistical solution to these outcomes in hopes of learning more about detecting sediment movement in this case study. Nonetheless, in future work it will be difficult, if not impossible, to quantify the volume of sediment transported as well as biomass lost unless these error discrepancies can be avoided.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Demonstration and integration of systems for fire remote sensing, ground-based fire measurement, and fire modeling.

JFSP Project No.: JFSP-03-S-01

Project Location: Ground sampling and instrumentation—Missoula, MT
Airborne thermal infrared—Riverside, CA
Integrated field research—any location Western U.S.

Principal Investigators: Colin C. Hardy, USFS, Rocky Mountain Research Station
Philip J. Riggan, USFS, Pacific Southwest Research Station

Contact Information (Phone, e-mail):

Colin Hardy, 406-329-4978, chardy01@fs.fed.us
Philip Riggan, 909-680-1534, priggan@fs.fed.us

Brief Description of Project: Proof-of-concept research is being conducted to: compare airborne and *in situ*, ground-based fire measurement systems; begin evaluation of two fire-behavior simulation models with these data; test approaches to incorporating improved wind-field and weather data in these models; test the utility of the airborne remote sensing for incident management; and, to develop a geodatabase architecture to facilitate sharing and integration of data. The Rapid Response study will provide an evaluation of the relative accuracy and efficacy of alternative remote sensing methods for characterizing fires, predicting fire effects, and supporting post fire severity mapping efforts. As many as four remote sensing approaches are implemented on each field deployment: *in situ* kinetic and radiometric thermal observations within a plot area which is to be burned over by the wildland fire; oblique-angle thermal radiometry from a viewpoint outside of the instrument deployment site; multi-spectral thermal infrared image acquisition from fixed-wing aircraft; MODIS sensor fire detection and mapping. Both pre- and post-fire ground sampling is performed within the plot to characterize fuel loadings and moistures, vegetation, overstory, and site attributes. Partners in field operations and data acquisition include co-investigators from the University of Montana (National Center for Landscape Fire Analysis) and Rochester Institute of Technology (Center for Imaging Sciences).

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): This Rapid Response Study was initiated in 2003 as a one year demonstration and proof-of-concept. Successes in 2003 lead to extension of the study as well as funding for additional field work as well as a second Phase of Geodatabase development. Lack of appropriate wildland fire incidents in 2004 resulted in an additional one year, no-cost extension of the study, with a June 1, 2006 final reporting and termination date. An update of study activities is given below.

- September, 2003—Combined ground-based and airborne remote-sensing measurements of wildfire properties and behavior were made in a rapid response to the Cooney Ridge Fire in western Montana. This effort involved close collaboration of research teams from the Missoula and Riverside Fire Laboratories and their cooperators. MODIS fire detection data were assessed for the time and place of this incident. A companion JFSP study (Morgan et al.) assessed the spatial distribution of fire severity on and around the sample site.
- August, 2003—Remote-sensing measurements of active wildland fires in western Montana were combined with geographic data to provide near-real-time intelligence to the Multi-Agency Coordination Group and Incident Commands during the 2003 fire siege. Data

were also used to initialize and calibrate simulations by the FARSITE model of fire behavior under a series of weather scenarios.

- October, 2003—Coordinated ground-based and airborne measurements were made on a prescribed fire at the Tenderfoot Creek Experimental Forest on the Lewis and Clark National Forest. This effort involved close collaboration of research teams from the Missoula and Riverside Fire Laboratories and their cooperators. MODIS fire detection data were assessed for the time and place of this incident. A companion JFSP study (Morgan et al.) assessed the spatial distribution of fire severity on and around the sample site. Field measurements for wind-flow modeling were acquired at 18 unique sample areas during the several prescribed burning periods for which two burns were executed at this site.
- March, 2004—Geodatabase workshop for all PIs, cooperators, and scientists. The workshop was Phase I of a sub-project performed by the University of Montana's National Center for Landscape Fire Analysis under as stipulated in the JFSP project plan. Workshop results include specifications for a geodatabase architecture to serve all data from all studies associated with the Rapid Response project.
- May, 2004—Implementation of pilot version of Geodatabase per workshop specifications.
- May, 2005—Implementation of Phase II agreement with University of Montana's National Center for Landscape Fire Analysis to develop a dynamic Geodatabase capable of serving data needs from multiple study deployments. This Geodatabase architecture is intended as a model for other interdisciplinary, integrated field studies, and will be presented at the 2005 JFSP PI meeting.
- July, 2005—An extensive field campaign on the Dragon Complex Wildland Fire Use (WFU) incident, North Rim of Grand Canyon, Arizona, resulted in two successful field deployments of the full suite of field measurements, instrumentation, and ground-based thermal infrared measurements. The Team was fully integrated into the incident management structure, including communications, daily Incident Action Plan, and cooperation with fire management resources. The Team presented two briefings, and provided a comprehensive closeout package to Gary Cones' Type I WFU Management Team.
- August, 2005—An extensive field campaign on the I90 Complex incident, western Montana, resulted in three successful field deployments—one with the full suite of field measurements, instrumentation, and ground-based thermal infrared measurements, and two without sampling of the plot's fuel or vegetation characteristics. The Team worked directly with the incident management organization to embed their study into daily operations on three divisions of this Type I incident. The Team provided a comprehensive closeout package to Bob Sandman's Type I Incident Management Team.

Issues/Concerns; changes in research objectives, methods, or products: None of the 2005 deployments included airborne thermal infrared observations. Several issues arose around availability and readiness of the aircraft and/or pilot that could not be mitigated. A final deployment of all field components as well as airborne measurements is planned this field season. Safety and operational protocols remain the primary concerns for ANY field campaign wherein personnel and resources are embedded within an ongoing incident. This Team has fully embraced the Incident Qualification System, and has among its membership high levels of fire qualifications, a comprehensive Job Hazard Analysis, an EMT, and has demonstrated an ability to fully integrate into an existing incident. These *lessons learned* are significant and will be shared for the benefit of leaders of other similar studies.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Climatic controls of fire in the western United States: From the atmosphere to ecosystems

JFSP Project No.: 01-1-6-05

Project Location: Corvallis/Eugene, Oregon

Principal Investigators: Steve Hostetler, Patrick Bartlein, Allen Solomon, Sue Ferguson

Contact Information (Phone, e-mail): 541 737-8928; steve@coas.oregonstate.edu

Brief Description of Project: The objective is to conduct a diagnostic analysis of the variations in climate that govern the characteristics of the fire season in the western United States on intra-annual through decadal and longer time scales. We propose a retrospective, model-based analysis to understand better the role of climate as a control of fire in the historical record, to evaluate the ability of a hierarchy of climate models to simulate multi-year and specific pre-ignition and contemporaneous climate associated with known fires (e.g., Yellowstone, 1988), and to examine the regional and temporal variability of western ecosystems and their fire-related vegetation variables. We will work collaboratively with Sue Ferguson USDA Forest Service to assess the ability of climate models to simulate a range of fire conditions over a variety of temporal and spatial scales.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

1. *Completed regional model simulations. Updated and compiled observed meteorological data set.* Our regional model simulations to cover the period 1948-2005 (to date) with our original model and from 1980-2000 with a newer model. We are completing post-processing of the output. We have updated, processed, and animated the meteorological data sets. Results and animations are available on our web site (<http://geography.uoregon.edu/fireclim/>). We are setting up data archives and data base management for serving the model output.
2. *Work on our atlas of fire relations for the western states continues.* We are applying composite anomalies and a number of other data analyses techniques to analyze fire-climate relations in subregions of the western US. The atlas will summarize the pertaining data and relations for end users and will be linked to more complete and extensive material on our website.
3. *Continue work with vegetation/fire simulation models.* We continue to modify and test the BIOME model and we are implementing a new dynamic vegetation model (LPJ). The work is being done primarily by Sarah Shaffer (USGS) who is also working with us on the project. We are testing the model using climate inputs derived from our RegCM simulations.

Issues/Concerns; changes in research objectives, methods, or products:

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Atmospheric Fire Risk (Haines Index) in a Changed Climate

JFSP Project No.: 03-1-1-37

Project Location: Michigan State University; USFS North Central Research Station

Principal Investigators: Julie A. Winkler and Brian Potter

Contact Information (Phone, e-mail): Winkler – (517) 353-9186; winkler@msu.edu. Potter – (517) 355-7740x28; bpotter@fs.fed.us

Brief Description of Project:

Our overall objective is to evaluate probable changes in the atmospheric potential for large or dangerous fires in a perturbed/future climate. The Haines Index, a composite measure of stability and humidity, is being used as the primary indicator of the atmospheric component of wildfire hazard. We are: 1) examining how well General Circulation Models (GCMs) simulate the variables that enter into the calculation of the Haines Index for the present climate; 2) evaluating the sensitivity of current Haines Index patterns to a changing climate; 3) assessing the range of uncertainty associated with projections of the Haines Index for a future climate; and 4) comparing the spatial patterns of the projected, future Haines Index climate to known, observed patterns of the index for the present and recent past climate.

In addition to these original goals, two additional objectives were added. We also are: 1) preparing a 40-year (1961-2000) climatology of the Haines Index for North America, and 2) evaluating multiple methods for calculating the low variant of the Haines Index. The first additional objective was necessitated by a lack of a long-term, spatially-extensive climatology of the Haines Index that could serve as a baseline for evaluating potential future changes. The climatology that we are developing is based on NCEP/NCAR reanalysis fields. While developing the climatology, we were faced with the decision of how to calculate the low variant of the Haines Index (used in eastern North America). Originally, the low variant used temperature at the 950 hPa pressure level as one of its terms. However, since the mid 1990s and the introduction of a new standard atmospheric observation level at 925 hPa, observations at the 950 hPa level are no longer regularly reported. An informal review of web sites regularly reporting the Haines Index indicated no currently agreed upon standard in the fire and fire weather communities for how to compute the low variant, and that several methods are currently in use. We are investigating the impact of these different methods in order to determine which method is more appropriate for our climatological analyses.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Deliverables (publications):

- Potter, B.E., J.A. Winkler, D.F. Wilhelm, R.P. Shadbolt, (under review): Computing the Low Elevation Haines Index. Submitted to *Fire Management Today*.
- Potter, B.E., J.A. Winkler, D.F. Wilhelm, and R.P. Shadbolt (forthcoming): Computation of the Low Elevation Haines Index. *Preprints*, Sixth Fire and Forest Meteorology Symposium/19th Interior West Fire Council Meeting, American Meteorological Society.
- Winkler, J.A. B.E. Potter, D.F. Wilhelm, R.P. Shadbolt, X. Bian, and K. Piromsopa (forthcoming): A Climatology of the Haines Index for North America Derived from NCEP/NCAR Reanalysis Fields. *Preprints*, Sixth Fire and Forest Meteorology Symposium/19th Interior West Fire Council Meeting, American Meteorological Society.
- Winkler, J.A. B.E. Potter, D.F. Wilhelm, R.P. Shadbolt (in preparation): Computing the Low Elevation Haines Index. In preparation for *Weather and Forecasting*.
- Winkler, J.A. B.E. Potter, D.F. Wilhelm, R.P. Shadbolt, X. Bian, and K. Piromsopa (in

preparation): Electronic atlas (both web-based and on CD) of Haines Index Climatology for 1961-2000.

- A number of additional publications are planned that will report on the long-term (1961-2000) Haines Index climatology and on the evaluation of the potential future changes in the Haines Index (with an accompanying assessment of uncertainty).

Deliverables (presentations):

- Winkler, J.A., 2005: Atmospheric Fire Risk in a Changed Climate. Presentation at the Eastern Area Modeling Consortium Science Meeting, USFS North Central Research Station, East Lansing, MI, June 23, 2005.
- Potter, B.E., J.A. Winkler, D.F. Wilhelm, and R.P. Shadbolt (forthcoming): Computation of the Low Elevation Haines Index. Poster Presentation at Sixth Fire and Forest Meteorology Symposium/19th Interior West Fire Council Meeting, American Meteorological Society, Canmore, Alberta, October 25-27, 2005
- Winkler, J.A. B.E. Pottern, D.F. Wilhlem, R.P. Shadbolt, X. Bian, and K. Piromsopa (forthcoming): A Climatology of the Haines Index for North America Derived from NCEP/NCAR Reanalysis Fields, Canmore, Alberta, October 25-27, 2005.
- Other presentations are planned including at least one presentation at the upcoming annual meeting of the Association of American Geographers in March, 2005.

Management Implications:

- Our comparison of three different methods for computing the low version of the Haines Index revealed that the choice of methodology has a large impact on the interpretation of the risk for plume-driven and erratic fires. In particular, direct substitution of the 925 hPa temperature for the originally-specified 950 hPa value resulted in a considerable underestimation of fire risk compared to the original index. We have communicated these findings to appropriate agencies, resulting in at least one organization changing the calculation method for the daily Haines Index values they distribute via the web.
- The forthcoming electronic climate atlas will be available to fire managers, providing them with information on the "normal" behavior of the Haines Index in their region and replacing the subjective evaluation of Haines Index behavior with scientific, objective information.

Issues/Concerns; changes in research objectives, methods, or products:

There are no major concerns at this point in the project. We have made considerable progress during the past year and are on track for meeting our objectives. As mentioned above, we added two additional objectives (development of a long-term climatology and evaluation of alternative methods for calculating the low variant of the Haines Index). In addition, we have been able to obtain simulations from a larger number of GCMs than we had originally proposed. This will allow us to better estimate the uncertainty surrounding future projections.

Although this project was scheduled to begin 1 August 2003, administrative processing prevented work from commencing until February 2004. While we have been able to make up this delay in many ways, we anticipate asking for a time extension so that we can ensure the quality of the final analysis and products.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: *Forecasting of fire weather and smoke using vegetation-atmosphere interactions*

JFSP Project No.: 03-13-02

Project Location: US FS, Rocky Mountain Research Station, Fort Collins CO

Principal Investigators: Karl F. Zeller and Ned Nikolov

Contact Information (Phone, e-mail): 970-498-1238, kzeller@fs.fed.us or nnikolov@fs.fed.us

Brief Description of Project:

Reliable forecasting of regional weather and wind flow patterns is critical for effective fighting of wildland fires and operational management of prescribed burns. Accurate forecasts of future wind fields, relative humidity, and stability are essential for predicting fire behavior; smoke dispersion, and mitigation of public health risks. Regional weather forecasts are currently produced by 3D meso-scale simulation models that are sensitive to lower boundary conditions defined by the surface exchange of heat and water vapor between terrestrial ecosystems and the atmosphere. These exchange processes are poorly described in current meso-models. This causes a great uncertainty in weather predictions beyond 10 hours. Hence, improving the biophysical representation of land-surface processes in meso-models might be a key step towards a more accurate forecast of fire weather and airflow. The project has three main objectives: 1) Improve weather forecasting capabilities of the MM5 meso-scale model by coupling it with a state-of-the-art biophysical model of soil-vegetation-atmosphere interactions named FORFLUX; 2) Use the coupled MM5-FORFLUX model to provide real-time operational weather forecast over the Western USA; 3) Deliver the improved forecast product on the Web in a user-friendly and operationally usable form to fire behavior analysts and land managers.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

The project has completed the following tasks thus far:

- Restructuring the original code of the FORFLUX model so that it can run on a 2D spatial grid. The model was converted into a subroutine that can be called within the MM5 meso-scale model.
- Assembling new vegetation data sets required by FORFLUX. These include: (1) a 1-km resolution dataset of canopy Leaf Area Index (LAI), and foliage clumping factor (CF) derived from satellite images, and (2) physiological and ecological input parameters for 27 land cover types covering Western US.
- Estimating FORFLUX-required hydraulic parameters by for 19 soil types.
- Designing and deploying a new user-friendly Website to deliver the comprehensive fire-weather & smoke forecast products of the USFS Rocky Mountain Center to Fire Management Officers and Air Resource specialists, see <http://FireWeather.info/> or <http://www.fs.fed.us/rmc/>

We are currently in a process of translating the modified Pascal code of FORFLUX into C++. The code translation will allow us to compile FORFLUX on a Linux platform using the PGI Inc. compiler in order to link it later with the MM5 code (which is written in C and Fortran).

Activities and deliverables planned for the next 4 months:

- Linking the restructured FORFLUX model code with the MM5 model code;
- Testing the newly coupled MM5-FORFLUX model against observations at a point and grid (spatial) level across the Western US;
- Assessing the effect of the new FORFLUX surface scheme on improving the accuracy of fire-weather forecasts over the Western US.
- Making the new fire-weather products operational and deploying them to the Web at <http://FireWeather.info/>
- Preparing and submitting a Final Report to JFSP.

Issues/Concerns; changes in research objectives, methods, or products:

Due to the overwhelming workload to our small team of four at the USFS Rocky Mountain Center over the past 15 months, we were forced to request a no-cost extension for the delivery of our end product and the Final Report on this project. The JFSP Management has granted us the extension.

**2005 JFSP Principal Investigator Workshop
Project Progress Report**

Project Title: An Automated System for Evaluating BlueSky Predictions of Smoke Impacts on Community Health and Ecosystems

JFSP Project No.: 03-1-3-09

Project Location: Seattle Washington

Principal Investigators: Susan M. O'Neill

Contact Information (Phone, e-mail): Susan O'Neill: 206-732-7851 E- oneill@fs.fed.us

Brief Description of Project: BlueSky, a National Fire Plan product, provides real-time predictions of surface smoke concentrations from prescribed fire, wildfire, and agricultural burn activities to aid land managers in burn/no-burn decisions.. One critical component of BlueSky that remains to be addressed, and that directly supports JFSP AFP 2003-1-Task3, is the development of an automated verification system to evaluate predicted impacts from smoke on communities and ecosystems. A verification system is necessary because land managers need to evaluate their burn decisions against potential National Ambient Air Quality Standard (NAAQS) exceedances, which requires a clear understanding of the accuracy of the predicted particulate matter (PM) concentration fields. We are proposing to develop this as a real-time tool to allow rapid verification and understanding of smoke dispersion models under all burn conditions

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Completed automated download and inclusion of Montana/Idaho prescribed fire info.
- Completed automated download and inclusion of WADNR burn information.
- Daily updates of prior 24 hour air quality across the U.S.: waiting for completion of data base of AirNow air quality data (due September).
- Commenced the analysis methods for comparison of BlueSky predictions with observations: 30% completed.
- Web-site display of evaluation results: not yet begun..

Issues/Concerns; changes in research objectives, methods, or products:

Everything is on track for completion by mid 2006.

2005 JFSP Project Progress Report – 03-1-1-06

Brief Description of Project: We are working in Yellowstone National Park to determine how initial post-fire structural heterogeneity controls carbon dynamics over the full cycle of individual forest stands, and how climate-mediated changes in the fire regime could potentially alter the behavior of the entire Yellowstone ecosystem as a net sink or net source in the global carbon cycle. The main objective of our project is to estimate how changes in fire frequency, pattern, and intensity will alter the distribution of forest age and structure across a landscape and how these changes, in turn, will affect the landscape carbon balance. We are using a combination of field measurements and modeling to determine how changes in climate and fire frequency will change landscape patterns of stand age and tree density, and how these landscape patterns alter carbon storage for the landscape. We are working to describe changes in all of the major pools and fluxes of the C cycle at temporal scales ranging from years to centuries, as influenced by periodic fires and different patterns of regeneration within a landscape where fire frequency will likely accompany changes in global climate, and can potentially alter C cycling dramatically.

Status Report: As of August 15, our research project has accomplished the following planned tasks:

- We have completed two full field seasons and sampled our planned 77 stands across the Yellowstone landscape. In each stand, we measured tree DBH and height, tree age, coarse woody debris, soils, forest floor and litterfall in three 10 x 50 meter plots. In 60/77 stands we also measured available soil N. In 30/77 stands we collected branches from upper, middle and lower crown thirds for foliar N. Samples processing will conclude fall 2005.
- We have completed harvesting of 15 trees in each of three stands, and the development of above and belowground biomass allometric equations. A MS thesis on this work was completed spring 2005 at the University of Wyoming.
- Initial modeling efforts have begun using Century; modeling efforts will be used to examine the potential effects of climate change on ecosystem productivity and carbon-nitrogen interactions.
- We have submitted an overview manuscript describing the links between climate change, disturbance, stand structure, and carbon cycling to *Bioscience* in summer 2005. This manuscript was presented at the ESA Annual Meeting in Montreal on August 10.
- We are currently conducting data analysis that will result in the submission of three additional manuscripts this year. The first will describe differences in carbon isotope ratios among lodgepole pine stands in Yellowstone and their implications for interpreting climate change; the second will describe changes in landscape-level carbon cycling between large fires in Yellowstone based on our field data, and the third will be based on our Century modeling results.
- Using data and experiences drawn from this project, we will participate in a discussion of examining landscape carbon storage with field measurements at the Ameriflux Science Team Annual Meeting in Boulder, Colorado in October.

- The ideas developed in our manuscript submitted to *Bioscience* are currently being applied in postfire reforestation efforts in Colorado, where a company establishing a power plant is hoping to use reforestation efforts as a “carbon credit” to offset its future emissions.

Issues/Concerns: We have had the following issues that have required minor changes in our originally-proposed methodology:

- The Yellowstone landscape lacks young (< 70 years old) stands due to effective fire suppression in the early 20th century. This age class is important to understanding changes in carbon cycling, and we have therefore supplemented it with stands from the National Forests that surround Yellowstone – though most of these stands were previously harvested.
- Stand age and density on this landscape are not easily sensed remotely, and our initial proposal of a map of these variables has been difficult to develop. Mapping age and density directly from Landsat or Aster imagery has been largely unsuccessful. We will be required to interpret these variables from rather complex multivariate models developed from available field data and imagery.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Prescribed fire strategies to restore wildlife habitat in ponderosa pine forests of the Intermountain West (Birds and Burns Network)

<http://www.rmrs.nau.edu/lab/4251/birdsnburns/>

JFSP Project No.: 01-1-3-25

Project Location: Idaho, Montana, Oregon, Washington, South Dakota, Colorado, Arizona, New Mexico

Principal Investigators: Vicki Saab and Bill Block (USDA Rocky Mountain Research Station)

Contact Information (Phone, e-mail): 406-994-5032, vsaab@fs.fed.us

Brief Description of Project: The USDA Forest Service Rocky Mountain Research Station (RMRS-4251) is leading the effort to examine fire effects on populations and habitats of wildlife in ponderosa pine forests in eight states across the western United States. In cooperation with 11 National Forests, Pacific Northwest Research Station, State Agencies, The Nature Conservancy, and several universities, this research program seeks to conduct effectiveness monitoring for prescribed fire to quantify reductions in fuel, evaluate effects of fuel reductions on habitat and populations of various bird species, and characterize bird community response to forest change following wildland and prescribed fire, namely for species dependent on fire-maintained habitats. At each location, prescribed fire treatment units are 600-1000 acres, and are paired with a control unit of equal extent. We survey birds to estimate population densities; monitor nests of cavity-nesting birds to determine nest densities, nest survival and productivity; and measure vegetation (e.g., fine fuels, ground cover, overstory cover, shrub densities, and log, snag and tree densities) at nest and count locations to identify key habitat descriptors. Results from ongoing wildfire research are being used to compare fuels, habitat, and bird populations with those monitored before and after prescribed fire treatments.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Accomplished & Planned Efforts

- FY02-04: 2+ yr pre-treatment data at all locations.
- FY04/05: Prescribed fire treatments on nearly 10,000 acres at 7 of 10 locations.
- FY05: 1 yr post-treatment data at 7 of 10 locations.
- Post Treatment Responses: Fire-associated species responding well to treatments; Black-backed & Three-toed Woodpeckers (Forest Service Sensitive Species) nesting in treatment units where they were absent prior to prescribed fire (Burn and They Will Come!).
- Standardized protocols used to quantify fuels, burn severity, wildlife habitat, & avian populations.
- FY06 Planned: Complete prescribed fire treatments on an additional 7,000 acres at 4 locations. Search for more funding to complete first (at 4 locations) and second years of post-treatment data.

Management Implications

- Providing consistent information on assessments of fuel reductions & burn severity, key to understanding ecological consequences of implementing the Healthy Forests

Initiative & National Fire Plan.

- Providing design criteria for prescribed fire projects to reduce fuels and enhance wildlife habitat.

Deliverables

- 200 page volume "Fire and Avian Ecology in North America" (Studies in Avian Biology No. 30) collectively reviews fire and avian ecology across 40 North American ecosystems.
- 2 fire-related publications in PSW-GTR-191.
- 6 presentations at scientific meetings.
- Short course taught on "Fire and Avian Ecology: Process Influencing Pattern," developed for RX510-Applied Fire Effects.
- MS thesis on bird use of Gambel oak before and after prescribed fire (University of Arizona).
- MS thesis on home range size of Black-backed Woodpeckers after wildfire (Boise State University)

Issues/Concerns; changes in research objectives, methods, or products:

Implementation of fire treatments continues to be delayed in units at four National Forests (Payette, Helena, San Juan, and Fremont). Because of partial treatments at some locations, we have yet to collect a full year of post-treatment data on the Okanagon, Fremont and Payette National Forests. Because treatments were not implemented as originally planned, the life of the project needs to be extended for 2 years. We were granted a 1 year no-cost extension for May 2006. However, we continue to search for alternate funding sources because we need additional time and funds to complete fuel reduction treatments and fully realize the study objectives: (1) conduct effectiveness monitoring for prescribed fire by quantifying reductions in fuels; (2) evaluate the influence of fuels reduction on habitats and populations of birds; and (3) develop management guidelines on designing and implementing effective prescribed burn projects and fuel reduction treatments while maintaining wildlife habitat. We fear that these objectives and associated products will be compromised if we are unable to extend the project until May 2007.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fuel consumption and flammability thresholds in shrub-dominated ecosystems

JFSP Project No.: 03-1-3-06

Project Location: USFS, Pacific Wildland Fire Sciences Laboratory, Seattle, WA

Principal Investigators: Clinton S. Wright, Roger D. Ottmar, Sue A. Ferguson, and Robert E. Vihnanek

Contact Information (Phone, e-mail): Phone: (206) 732-7827 e-mail: cwright@fs.fed.us

Brief Description of Project:

This project is conducting field-based experiments to quantify fuel consumption and flammability thresholds in three shrub-dominated ecosystems (big sage, chaparral, and southern flatwoods). Sampling includes collection of pre- and post-burn fuel type, amount and arrangement data, and day-of-burn weather and fuel moisture data. Empirical models developed from field data will be incorporated into the software package CONSUME.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- This project was initiated in July 2003, with development of experimental methods, identification of potential collaborators in various Federal land management agencies, and reconnaissance of prospective field sites.
- Thirteen field sites in big sagebrush fuels in western Montana were pre-burn sampled in summer 2003, and burned in spring 2004. Three additional sagebrush sites were sampled in summer 2004 and are scheduled for burning in fall 2005. Up to six additional sagebrush sites will be sampled and burned in the summer/fall of 2005 and spring of 2006.
- Nine flatwoods field sites in northwest Florida were pre-burn sampled in winter 2003/2004. Of those nine sites, three were burned in early 2004, and six sites were re-sampled and burned in early 2005. Twenty-two sites in north-central Florida and southern Georgia were sampled and burned in winter/spring 2005 (during the dormant season), and seven sites in north-central Florida were sampled and burned in spring/summer 2005 (during the growing season). Up to ten additional sites will be sampled and burned during the dormant and growing seasons in 2005/2006.
- Two hard chaparral sites in southern California were sampled and burned in winter/spring 2005. Additional sites had been identified, but owing to record-breaking precipitation (and an unpredictable burn window) in southern California, field sampling in the region was curtailed. Additional sites will be sampled and burned in the winter/spring of 2005/2006.
- Data reduction and summary analysis is ongoing. Summary results by site will be distributed to cooperating land management organizations as data summaries are compiled.
- Model development, study documentation, and technology transfer will proceed in the spring of 2006 and continue as data collection in the various fuel types is completed.

Issues/Concerns; changes in research objectives, methods, or products:

- As with all field experiments that rely upon operational prescribed fires for data, weather- or logistics-related delays in burning impact data collection efficiency. Continued unusual weather patterns in the southwest U.S. could extend the time required for adequate data collection in the chaparral ecosystem type.
- Movement of collaborators among agencies and locations has forced us to cultivate new contacts with local fire managers to identify field sites somewhat slowing the process.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Forest Floor Consumption and Smoke Characterization in Boreal Forested Fuelbed Types of Alaska

JFSP Project No.: 03-1-3-08

Project Location: Pacific Wildland Fire Sciences Laboratory, 400 North 34th Street, Suite 201, Seattle, Washington 98103

Principal Investigators: Roger D. Ottmar, Sue Ferguson, and Robert Vihnanek

Contact Information (Phone, e-mail): Phone: (206) 732-7826; Fax: (206) 732-7801; e-mail: rottmar@fs.fed.us

Brief Description of Project: Many areas of the boreal forest of Alaska contain deep layers of moss, duff, and peat, resulting in a large pool of biomass that potentially can burn and smolder for long periods of time creating hazardous smoke episodes for local residents and communities and causing detrimental landscape impacts. Research to quantify fuel consumption, flammability thresholds, and smoke production in boreal forest types is critical for effective modeling of fire effects (e.g. smoke emissions, regional haze, permafrost melting, erosion, plant succession, etc) and landscape management if prescribed burning is to become an important fuels treatment method in the future. Preliminary research has generated a hypothesis of the controlling variables that govern the fuel consumption in the moss and duff layers, but this hypothesis needs to be verified and tested through field-based experimentation. Very limited smoke emissions characterization has been completed. This study will collect fuel consumption data and characterize smoke emissions on active wildfires and prescribed fires. The data will be used to develop new and modify existing forest floor fuel consumption models and develop emission rate equations for the boreal forest fuelbed type.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Science Delivery:
1. Inventoried and measured fuel consumption on 25 sites in front of wildfires during 2003 and 2004.
 2. Measured smoke emissions on 8 of the 25 sites.
 3. Completed one proceedings paper.
 4. Completed duff consumption model for Consume 3.0
 5. Implemented duff consumption model into Consume 3.0. Expected release of the software: October 2005.
 6. Completing reduction and summary of Alaska emission factor data collection.
 7. Two manuscripts are being prepared along with a Consume Users manual.

- Applications:
1. 10 fuel consumption and Consume 3.0 demonstrations and exercises were presented at several national and regional training session including RX 410 (Smoke management), RX 300, (Burn Boss), and RX 310 (Fire Effects).

- Management:
1. Consume 3.0 will enable managers to easily and quickly evaluate and predict fuel consumption and total emissions produced by fuelbed category for the flaming, smoldering, and residual combustion phases. This will improve the fuels and fire planning for fire effects and smoke management reporting. Thousands of

managers use Consume 2.1 and will find Consume 3.0 much more versatile, improved, and applicable to more areas of the United States including Alaska.

Issues/Concerns; changes in research objectives, methods, or products: None. The project is ahead of schedule with the model development complete and the fuel consumption data being implemented into the Consume 3.0 release scheduled for October 2005. Two manuscripts and a Consume 3.0 users manual are in preparation.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of grass seeding and salvage logging on fuel loads, potential fire behavior, and biological diversity of severely burned low elevation southern Oregon forests

JFSP Project No.: 03-1-4-11

Project Location: Southwestern Oregon

Principal Investigators: J. B. Kauffman, W. D. Robinson, B. E. Law, T. Sensineg, T. Sexton, G. Reigel

Contact Information (Phone, e-mail): boonekauffman@fs.fed.us

Brief Description of Project:

We are investigating the short- and longer-term responses to post-fire salvage logging and re-burn of salvage-logged stands in the Siskiyou Mountains of southwestern Oregon. Our team is measuring both vegetative and vertebrate responses. Two years of sampling have been conducted within areas severely burned by the 2002 Biscuit Fire; areas salvaged within that burn; sites salvaged after a 1987 fire and re-burned by the Biscuit Fire; sites salvaged after a 1987 fire but not re-burned; and unburned areas.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Science delivery and application:

- Planned field days with land managers to tour sites and discuss preliminary results.
- Two graduate students (1 Master's, 1 Ph.D.) producing theses, mentoring field technicians, and participating in undergraduate instruction of a course on Biscuit Fire impacts on terrestrial amphibians.
- Expect a minimum of four publications in peer-reviewed journals.
- Developing web site with outreach materials, summary of results in reports and journal articles, and developing a circular for public distribution.

Management utility of research:

- Provides information for future post-fire management situations on public lands.
- Fire behavior modeling of fuel profiles altered by salvage logging will provide guidance on fuel treatment prescriptions following salvage logging and will allow evaluation of how salvage may influence risk of re-burn.

Integration of habitat changes due to salvage logging and habitat needs of species of interest will provide managers with information necessary for assessing potential impacts of salvage logging on species of concern.

Issues/Concerns; changes in research objectives, methods, or products:

The original focus of the project was on a chronosequence spanning 17 years where we wished to evaluate correlates of post-fire salvage and grass seeding on plant and vertebrate community dynamics. A lack of appropriate sites at some points in the chronosequence and a paucity of sites with post-fire grass planting caused us to shift focus to two particular fire years (1987 and 2002) where we can investigate the consequences of re-burn after salvage logging.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Designing a set of protocols for evaluating multi-scale effects of fire and fire surrogate treatments in the sagebrush biome

JFSP Project No.: 03-1-4-21

Project Location: La Grande, Oregon – PNW Research Station

Principal Investigators: J.D. McIver, J. Chambers, C. D'Antonio, P. Doescher, S. Karl, R. Miller, M. Pellant, D. Pyke, R. Tausch, M. Wisdom

Contact Information (Phone, e-mail): james.mciver@oregonstate.edu

Brief Description of Project:

This project developed a comprehensive set of protocols that will now be used to evaluate the effects of fire and fire surrogate treatments that are intended to restore sagebrush communities of the Great Basin. The set of protocols represents a multi-scale experiment that: 1) will provide managers with information to restore sagebrush ecosystems that is relevant across the 100+ million acres of the sagebrush biome; 2) is matched to the temporal and spatial scales at which managers operate; and 3) reduces management risk and uncertainty of catastrophic wildfire to the greatest degree possible.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Funding was released in summer 2003, and the project was terminated on April 30, 2005. All three project objectives were satisfied: 1) we reached agreement on the design of the experiment, developed ownership in managers and stakeholders, and produced a comprehensive proposal that was submitted to and funded by the Joint Fire Science Program Governing Board on February 16, 2005.

The objectives for this project reflect a research program that seeks to determine the conditions under which sagebrush steppe communities will recover on their own following treatment, versus conditions that will require expensive active restoration. Specific objectives include:

- (1) Identify the abiotic and biotic thresholds that determine sustainability of big sagebrush plant communities in sagebrush-steppe and sagebrush semi-desert environments, specifically related to threats posed by cheatgrass and pinyon-juniper invasion.
- (2) Assess the ecological effects of fire and fire surrogates on big sagebrush communities at risk of crossing a threshold of conversion to cheatgrass or pinyon-juniper, beyond which restoration may be difficult or logistically infeasible.
- (3) Document how fuel loads change across vegetation treatments and ecological conditions in relation to the objectives above.
- (4) Portray the ecological, economic, and socio-political trade-offs and treatment effects of no action, applying only fire and fire surrogate treatments, and restoration treatments in these sagebrush communities.
- (5) Identify and measure environmental benefits affected by conversion to cheatgrass and pinyon-juniper systems, and identify induced changes in welfare to human populations.
- (6) Provide insight and guidance regarding use of our results for effective multi-species and multi-scale planning as part of ecosystem management of sagebrush communities in the Great Basin.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Assessing the Causes, Consequences and Spatial Variability of Burn Severity: A Rapid Response Proposal

JFSP Project No.: 03-2-1-02

Project Location:

University of Idaho, Latah County, Moscow, ID, First Congressional District

Forestry Sciences Laboratory, Rocky Mountain Research Station, USDA Forest Service, Moscow, ID, Latah County, Moscow, ID

Fire Sciences Laboratory, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT

Data have been collected from fires in Montana, California, Idaho and Alaska

Principal Investigators:

Penelope Morgan, Andrew Hudak, Pete Robichaud, Kevin Ryan

Contact Information (Phone, e-mail):

Penelope Morgan, pmorgan@uidaho.edu, Phone: 208-885-7507, Fax: 208-885-6226

Description of Project:

In this rapid response project, we have collected data on post-fire effects and pre-fire fuels and vegetation from 10 large fires that burned in 2003 and 2004. We use field and remotely sensed data collected during and soon after wildfires to quantify the interactions and spatial variability in fire effects, fuels, fire behavior, local weather and topography and to assess the accuracy of current and alternative image analyses for remote sensing of burn severity. We coordinate our work, share data, and communicate improved burn severity assessment approaches with Fire Management Teams (e.g. Incident Command and Burned Area Emergency Rehabilitation teams), managers, scientists, and others. Our efforts complement ongoing research and management applications by comparing alternative remote sensors and analysis approaches across a diversity of soils, vegetation, and fire conditions, and by explicitly linking fire behavior, fuels and fire effects to quantitative indicators of burn severity that can be assessed in the field, predicted from fire effects models, mapped quickly and accurately, and scaled. Our project will thus improve the assessment of the severity of post-fire effects, including the potential for erosion and sedimentation, and thus the strategic effectiveness of post-fire rehabilitation. We will work to develop a rapid yet consistent burn severity mapping approach that is applicable to different types of imagery (depending on which is available at the time). We will share our results at Burned Area Emergency Rehabilitation training, on the FIREMON (<http://www.fire.org/firemon/>) and FRAMES (www.frames.gov) websites, and with the USFS Remote Sensing Applications Center staff to improve procedures for mapping fire effects. This project is linked with JFSP 03-S-01 (Hardy et al.).

Status Report:

We are making excellent progress on a 3-year project. In addition to the PIs and collaborators, our team includes a postdoctoral research scientist, a civil engineer, a GIS analyst, and six different undergraduate students who assisted us in the field during the summers of 2003 and 2004. We have worked closely with Incident Command Teams and Geographic Area Coordinating Committees.

Research accomplishments:

Detailed sampling of burn severity on fires immediately post-fire and one year later on 10 wildfire incidents: Porcupine, Chicken, Wall Street (in Alaska), Roberts, Wedge, Cooney Ridge, Black Mountain (in Montana), Simi and Old (in California) and Flannigan (Idaho). Burn severity in these 2003 and 2004 wildfires ranged from unburned to low, moderate and high. Spatial variability was high. Areas burned most severely were relatively uniform, while the spatial heterogeneity of moderate and low severity burns was respectively high and higher.

- Hyperspectral imagery was obtained on eight fires: Porcupine, Chicken (Alaska 2004) Roberts, Wedge, Cooney Ridge, Black Mountain (in Montana 2003), Simi and Old (in California 2003) fires. These very high-resolution data are being analyzed to assess spatial variability and to develop indices of burn severity that correlate closely with our field data.

- Compiled a spectral data library from low, moderate, and high severity, and from unburned sites. Once assembled into the data library (in progress), these data will be used to improve interpretation and application of the remotely sensed data from aircraft and satellites.
- Compared the accuracy and applicability of alternative remote sensing approaches for mapping burn severity across a diversity of soils, vegetation, and fire conditions. Based on our ongoing analysis, we will recommend indicators of burn severity that are readily mappable and scalable – that is, measurable on the ground as well as remotely.
- Sampled on some of the same sites and exchanging data with Hardy et al. (JFSP 03-S-01), Ottmar et al. (JFSP 03-1-3-08), and Camp et al. (JFSP 04-2-1-96).

Technology transfer accomplishments:

- Shared our results with the USFS Remote Sensing Applications Center staff to improve procedures for mapping fire effects. In this year we will share our results with Burned Area Emergency Rehabilitation specialists, on the FIREMON (<http://www.fire.org/firemon/>) and on the FRAMES (www.frames.gov) websites.
- Organized a panel discussion about mapping burn severity on the 2003 Montana fires with Henry Shovic, BAER team leader and researchers at the University of Idaho and RMRS- Moscow.
- Organized a panel discussion about lessons learned from rapid response research for the Nov. 2005 PI meeting; a short paper jointly written by scientists and managers will be submitted to Wildfire Magazine.
- We participated in two database design workshops held in July 2003 and March 2004 to coordinate data sharing between our rapid response project and others, including Hardy et al. (JFSP 03-S-01) and Finney et al. (JFSP 03-2-1-04).
- Our project web site (http://www.cnr.uidaho.edu/burn_severity) provides information on our objectives, methods, products, and pictures. We periodically update this site.

Publications:

- Hudak, A., P. Robichaud, T. Jain, P. Morgan, C. Stone, and J. Clark. 2004. The relationship of field burn severity measures to satellite-derived burned area reflectance classification (BARC) maps. *Proceedings, ASPRS Annual Meeting*.
- Stone, C., A. Hudak and P. Morgan (2004). Forest harvest can increase subsequent forest fire severity. In: *International Symposium on Fire Economics, Policy & Planning: A Global Vision*.
- Hudak, A., J. Evans, P. Robichaud, J. Clark, K. Lannom, P. Morgan, and C. Stone. Field validation of burned area remote classification (BARC) products for the purpose of rapid response. USFS Remote Sensing Workshop.
- Hudak, A., P. Morgan, M. Bobbitt and L. Lentile. Characterizing Clearcut Harvest and Severe Fire Disturbance Patches in a Forested Landscape: A Case Study from Cooney Ridge, Montana. Chapter 8 In: *Forest Disturbance and Spatial Patterns, GIS and Remote Sensing Approaches*, M. Wulder and S. Francis, eds. Taylor and Francis – CRC Press.

Presentations:

- USFS Remote Sensing Workshop, Salt Lake City, UT, April 2004
- ASPRS (American Society of Photogrammetry and Remote Sensing) Annual Mtg., April 2004.
- International Symposium on Fire Economics, Policy & Planning: A Global Vision, April 2004, Spain
- Fire Symposium, University of Idaho, Moscow, ID, September 25, 2004.
- Mixed Severity Fire Regimes: Ecology & Management Conference, Spokane, WA Nov. 2004
- Association of American Geographers Meeting, Denver, CO, April 2005

Issues/Concerns affecting the project:

We have lots of data, and we are working intensively to analyze and interpret it. We sampled ten fires when our proposal committed us to sampling two. We obtained hyperspectral imagery for eight instead of the one fire we originally proposed. Both scientists and managers are interested in our preliminary results. The hyperspectral imagery has been challenging to acquire and analyze. RSACs assisting us.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of blowdown, beetle outbreak, and fire history on the behavior and effects of the 2002 fires in western Colorado

JFSP Project No.: JFSP proposal no. 03-2-2-01; BLM IA no. 1422RA103-0001

Project Location: Western Colorado

Principal Investigators: Thomas Veblen and Dominik Kulakowski

Contact Information (Phone, e-mail): 303-492-6760, veblen@colorado.edu

Brief Description of Project:

We are examining relationships between pre-fire forest conditions and the behavior and effects of the severe 2002 fires in subalpine forests in western Colorado. The study is based on high-quality and unique pre-fire data on the extent and severity of fires, blowdown, and beetle outbreak in areas of Routt and White River National Forests that were affected by the 2002 fires. The objectives of this research are to analyze and describe the influences of the pre-fire disturbance history on the extent and severity of the 2002 fires and ensuing forest recovery in subalpine forests of western Colorado.

Regional and landscape analysis of our existing data and recent Forest Service spatial data sets of the 2002 fires are being conducted in a Geographic Information System (GIS). This analysis focuses on the interactions between sites' disturbance history and the spread and severity of the 2002 fires. In the field, finer scale (intra-stand) analysis is being conducted on disturbance interactions and post-fire recovery (i.e. tree regeneration).

Our existing data and the 2002 fires present a unique opportunity to gain an understanding of the effects of large natural disturbances on fire behavior and post-fire recovery. Such information is critical to long-term forest planning and management in the context of probable future fires of high severity in Rocky Mountain subalpine forests.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Analysis has been completed on the influences of pre-fire disturbance history on the extent and severity of the 2002 fires. All relevant data sets have been compiled and spatial models of the severity of the 2002 fire severity in relation to prior disturbance history are being developed in a Geographic Information System. A paper from one study area (Big Fish Lake, Flattops, White River NF) has been accepted for publication (Bigler et al. 2005). A draft of a paper from the second study area in the Routt Divide blowdown has been produced and will be submitted for publication in late 2005.

To monitor post-fire establishment following the 2002 fires, permanent plots were established in areas that vary in pre-disturbance history. Data on regeneration during years 2003, 2004 and 2005 have been collected and are being analyzed.

Science Delivery:

Bigler C., D. Kulakowski and T.T. Veblen (2005). Multiple disturbance interactions and drought influence fire severity in Rocky Mountain subalpine forests. *Ecology*. In press. (On the North Fork of the White River, Flattops, 2002 fire).

Kulakowski, D. and T.T. Veblen. Effects of disturbance history on the extent and severity of fire during extreme drought. (Draft m.s. on the 2002 Routt Divide fire).

Summary Statements from Bigler et al. (2005):

1. Overall, the most important predictors determining the severity of the 2002 fire were stand structure, forest cover type, the late 1800s fires, and elevation. Despite the occurrence of the 2002 fire in conjunction with exceptional drought, pre-burn stand conditions (related mostly to disturbance history) and topography explained 42% of the spatial variability of fire severity.
2. Subalpine forests that originated after severe fires in the late 1800s were less likely to burn in the year 2002 than older forests.
3. Spruce-fir forests affected by the 1940s spruce beetle outbreak were slightly more likely to burn in 2002, in particular at a high burn severity.
4. Aspen and lodgepole pine stands which established after the late 1800s fires were less likely to burn in 2002, whereas spruce-fir forests were more likely to burn.
5. The highest elevations (> 3100 m) had the lowest probability of burning, whereas intermediate elevations (2900-3100 m) had a higher probability of burning at high severity.
6. Because our results show that pre-burn stand conditions are important influences on burn severity even for fires burning during extreme drought, management practices that alter stand conditions (cover types and stand structures) can be used to modify the severity of future burns.

Issues/Concerns; changes in research objectives, methods, or products:

None.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Pre-fire condition, fire severity, and post-fire effects in the Hayman burn, Colorado

JFSP Project No.: 03-2-3-08

Project Location: Hayman burn, Colorado

Principal Investigators: Merrill R. Kaufmann, Natasha B. Kotliar

Contact Information (Phone, e-mail): Merrill Kaufmann (970-498-1256; mkaufmann@fs.fed.us)

Brief Description of Project: Research within the 2002 Hayman burn provided an excellent framework for comparing effects of the Hayman burn to pre-fire forest conditions. Two pre-fire data sets supported the research. One characterized historical landscape structure and processes and included plot-level measurements of forest overstory structure, understory species composition, fuels, and fire history. The second dataset was pre-treatment monitoring data collected as part of the Upper South Platte Restoration Project, which included forest overstory and understory plant data, surface fuels, and habitat monitoring for several species of concern. Our primary objectives focused on re-sampling our pre-burn plots near Turkey Creek and Saloon Gulch to (1) evaluate the effects of burn severity, pre-fire stand characteristics, and topography on tree survivorship; (2) determine the effects of burn severity and pre-fire composition on post-fire understory species composition; (3) examine the effects of pre-fire fuels and vegetation structure on patterns of burn severity, and (4) investigate the effects of burn severity on habitat for species of concern.

Status Report:

- Objective 1: The manuscript is nearly complete and will enter the internal review process at the Rocky Mountain Research Station by the middle of August 2005. Upon completion of the internal review process, the manuscript will be submitted to the International Journal of Wildland Fire for consideration. Raw data have been shared with the developers of FFE- FVS to improve and calibrate their model. The manuscript will be shared with land managers of the Colorado Front Range and management implications of the findings will be discussed.

Results of this research indicate that the probability of mortality for an individual tree due to wildfire is a function of factors at multiple spatial scales. Variables that describe tree morphology, the local neighborhood structure, and the broader stand structure were all meaningful in predicting the probability of mortality for an individual tree. These findings may help land managers better understand the potential impact of future fires on individual trees of concern.

- Objective 2: The manuscript is currently being drafted and will enter the internal review process at the Rocky Mountain Research Station by September 2005. Upon completion of the internal review process, the manuscript will be submitted to the International Journal of Wildland Fire for consideration. The manuscript will be shared with land managers of the Colorado Front Range and management implications of the findings will be discussed.

Research findings indicate that wildfire had a marginal effect on native and exotic understory species richness, though percent cover was significantly impacted. Prior to the Hayman Fire, 157 native species were identified in the plots, with an average of 45 species per plot; average cover by native species was 26%. One year after the fire, 140 native species were found in the plots, with an average of 48 species per plot. Average native cover declined to 13% post-fire. In total, 14 exotic species were identified in the plots prior to the Hayman Fire, with an average of 2 exotic species per plot; average exotic cover was less than 1%. After the fire, 18 exotic species were found, with an average of 5 exotic species per plot. Average exotic cover increased to 2% post-fire. These findings will help land managers better understand and plan for the effects of fire (both prescribed and natural) on understory plant communities of the Colorado Front Range.

- Objectives 3 and 4: Significant progress has been made, but time constraints for the co-PI related to family health issues have limited synthesis and summary of results. Additional work is underway and will be reported to the JFSP as soon as available.

Issues/Concerns; changes in research objectives, methods, or products:

Delay in completing Objectives 3 and 4 (above).

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Quantification of Runoff and Erosion on Semi-arid Grasslands following a Wildfire
JFSP Project No.: 03-2-3-11

Project Location: Tucson, Arizona

Principal Investigators: G.B. Paige, J.J. Stone, D.P. Guertin, G.J. Gottfried, S. Gunzel

Contact Information (Phone, e-mail): (307) 766-2200, gpaige@uwyo.edu

Brief Description of Project:

Rainfall simulator experiments are being conducted to measure infiltration, runoff and erosion rates following a wildfire on a semi-arid grassland. This study addresses task RFP-2003-2-Task 3. The objectives are to: 1) quantify the changes in runoff and erosion responses immediately after and for the subsequent two year period following a wildfire in a semi-arid grassland, and 2) use the data from burned and unburned rainfall simulator plots to develop semi-arid grassland parameters for Disturbed WEPP. To accomplish these objectives, rainfall simulation techniques are being used to monitor the post-wildfire runoff and erosion rates on the two NRCS Ecological Sites. In addition, rainfall simulator experiments are being conducted on the same two Ecological Sites in an unburned condition. The data gained from this project are being used to: 1) quantify runoff and erosion processes on semiarid grasslands following a wildfire, and 2) develop an input parameter dataset for semi-arid grassland ecosystems for the Disturbed WEPP post fire erosion risk management tool (ERMiT).

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

As of October 2004, three years of rainfall simulation experiments have been conducted on the burned sites and one year on the unburned sites. Recording raingages and soil moisture and temperature probes were installed at the two burned sites in April 2004.

Rainfall Simulator Experiment Results:

- The results immediately following the wildfire showed an increase in the runoff ratio (runoff/rainfall) from 5 to 74% and in the sediment yield ratio (sediment yield/runoff/slope) from 399 to 2230% for the Limey Slopes and Loamy Upland Ecological Sites, respectively.
- The runoff ratios for both sites are now approaching those for unburned sites.
- The sediment yield ratio has been decreasing steadily for both ecological sites and is approaching the values from the unburned sites.
- There has been relatively little change in the total ground cover while the canopy cover has been increasing steadily since the fire. After two years, the canopy cover is approximately equal to values for pre-fire conditions measured at both sites. However, the ground cover is still less than pre fire conditions, primarily due to differences in litter cover.

Science Delivery:

The results from the first two years of rainfall simulator experiments were presented at:

- 1) Second International Wildland Fire Ecology and Fire Management Congress in Orlando Florida in November 2003 (Paige et al. 2003), and
- 2) First International Conference on the Watersheds in Benson, AZ in October 2003 (Stone and Paige, 2003).

Preliminary results from the 3 years of rainfall simulator experiments were presented at the University of Wyoming, Laramie WY in October 2004 (Paige, 2004)

Planned science delivery and application efforts (2005-2006)

- Parameter Estimation for Disturbed WEPP –data from this project as well as other post-fire experiments are being used to parameterize the hydrologic and erosion components of Disturbed WEPP. These parameter values will be used with plot cover and soils data to develop parameter estimation relationships to be used with the USFS ERMiT software.
- Documentation – Documentation of the results will include 1. a peer review journal article of the effects of the recovery process on runoff and erosion at the two sites, 2. a peer review journal article of WEPP parameter optimization and estimation for burned conditions on semiarid grasslands, 3. a complete summary and data compendium of the results from the experiment for the personnel from the USFS, the BLM, and regional BAER teams, and 4. a final report for the JFSP.
- Technology Transfer – A workshop will be held in Spring 2006 for action agency personnel outlining the results of the experiment and the use of WEPP and other tools for immediate post fire assessment and the potential recovery rate to pre fire conditions.

Issues/Concerns; changes in research objectives, methods, or products:

A one year extension (to August 2006) of the project was granted by JFSP. The additional benefits that will be provided to JFSP are:

- 1) Data and analysis from 2 additional wildfire sites in Southeastern Arizona will be included in the parameter identification process for the erosion risk assessment tool model.
- 2) More robust parameter identification for the erosion risk management tool – recently, improvements have been made to the rangeland erosion model that should result in improvements in our ability to model the post-wildfire hydrologic and erosion processes.
- 3) The Technology Transfer workshop, now scheduled for the spring of 2006 will incorporate results from all three wildfire sites as well as results from the improved rangeland erosion model.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: The Effects of Soil Properties, Fuel Characteristics, and Vegetation Recovery on Post-Fire Watershed Hydrology and Sediment Yield in Chaparral Steeplands

JFSP Project No.: 03-2-3-13

Project Location: San Dimas Experimental Forest, southern California

Principal Investigators: Peter Wohlgenuth, Marcia Narog, Jan Beyers

Contact Information: (951) 680-1500 pwohlgenuth@fs.fed.us mnarog@fs.fed.us jbeyers@fs.fed.us

Brief Description of Project:

In September 2002, the San Dimas Experimental Forest burned in a high severity wildfire. In these southern California chaparral ecosystems, steep slopes, erodible soils with high levels of hydrophobicity, and the loss of vegetation cover combine to produce accelerated post-fire runoff and erosion. The wildfire provided a unique opportunity to compare the post-fire hydrologic and sediment yield response of the same instrumented small watersheds that previously burned in a wildfire in 1960. Documenting the differences in runoff and erosion using historic and modern datasets, including some watersheds that were subjected to the management manipulation of vegetation type conversion that altered the pre-fire fuel characteristics and structure, will serve as a benchmark to test existing runoff/erosion models. Moreover, detailed information on soil properties, fuel characteristics, and vegetation recovery should better explain the observed variations in hydrologic and sediment yield response from these burned watersheds.

Status Report:

Data collection, reduction, and synthesis are ongoing:

- Stream runoff and sediment yield data have been collected for three years;
- Detailed vegetation information have been collected for two years;
- Soil characteristics and data on the properties of water repellency and soil moisture have been collected for two years;
- Historical datasets for runoff, sediment yield, pre-fire vegetation, and fuels characteristics have been summarized.

Preliminary science deliverables and technology transfer have been accomplished:

- A field trip to the San Dimas Experimental Forest advertising the scientific goals and management implications of the project to local federal, state, county, and municipal land managers attracted over 50 people in September 2003;
- Portions of the work have been presented at scientific symposia.

Pending science deliverables and technology transfer include:

- A workshop/field trip to communicate the scientific knowledge and management lessons to a hopefully larger group of local land managers will be held in at the Riverside Forest Fire Laboratory or the San Dimas Experimental Forest in the Spring of 2006;
- A series of scientific journal articles and management reports will be published in 2006 discussing the detailed results of the vegetation comparisons, the soils properties and water repellency, and the stream runoff and sediment yield from the various small watersheds. A synthesis paper will be produced in 2007 that ties

together the research from the different scientific disciplines.

Management Implications:

- Herbaceous fire followers have dominated the vegetation communities since the wildfire;
- The type converted watersheds have fewer plant species and more bare ground;
- The native chaparral watersheds have greater plant diversity and the largest individuals;
- Soil water repellency shifts with season and soil moisture content, but was not significantly different between type converted and native chaparral watersheds;
- Stream runoff was expectedly large during the first winter after the fire for all watersheds, despite moderate rainfall;
- Stream runoff was comparably large for all watersheds during the third post-fire winter, resulting from record rains;
- Sediment yield was expectedly large for all watersheds during the first post-fire winter, but negligible for the second year, and minor during the third year, despite record rains.

Issues/Concerns; changes in research objectives, methods, or products:

Funding delays made a determination of seedbank germination impossible. A no-cost one-year extension of the project was recently approved. The additional year of soils, vegetation, runoff, and sediment yield data will substitute for the seedbank work. Ken Hubbert, the soil scientist, is no longer in federal service and has left the team.

Consequently, the ground-penetrating radar and the time domain reflectometry for soil moisture determination have been eliminated from the project. Soil depths are now being determined with a soil auger at dozens of locations throughout each small watershed. Soil moisture is now being determined gravimetrically at two depths for many locations throughout each small watershed several times a year.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Post-Fire Avian Response to High Fire Severity

JFSP Project No.: 03-2-3-15

Project Location: San Diego County, CA

Principal Investigators: Philip Unit: San Diego Natural History Museum

Jan Beyers and Marcia Narog: USDA Forest Service, PSW Research

Contact Information (Phone, e-mail): 951-680-1548 ; mnarog@fs.fed.us

Brief Description of Project:

Fire and resource managers need additional information on potential fire effects for local species and their habitats to facilitate fuels management projects in southern California. The information gathered on bird diversity, numbers and habitat will be relevant as baseline data derived from a typical southern California wildfire. Pre-fire data will be compared with post-fire to determine extent of bird diversity and number recovery. This information will fill some critical fire effects knowledge gaps and can be used when justifying prescribed burning to improve wildlife habitat.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Final post-fire bird (spring) and vegetation data have been collected and are being entered into project database.

Bird species diversity increased initially after the fire, but has now leveled out.

Post-fire bird numbers continued to increase over time: 1-2 yr was 2.7 times and 2-3 yr (winter only data) was 3.7 times more than 0-1 yr observations.

Many bird species continue to recover in number since the fire, but a few have declined.

Small sedentary birds of chaparral were affected the most severely and are recovering slowly.

Winter visitors characteristic of mature chaparral were nearly eliminated from study sites; almost none had returned even 3 years after the fire.

Some bird species were eliminated from burned forests, surviving only in small unburned patches; almost none had re-colonized burned forests by 2 years after the fire.

Most but not all summer visitors have returned to the burned forests.

Vegetation recovery was observed as increased height and cover over time.

An integrated analysis of habitat and bird data may improve understanding of post-fire recovery of bird populations.

The data gathered over time from the 60,000 acre Pines wildfire indicate a great range in post-fire effects on the local and migrant bird communities. This cumulative information database can be used as a baseline to compare with future fires (natural and prescribed) in different vegetation types to help predict effects.

OUTPUTS:

Slide presentation to San Diego Partners for Biodiversity, Aug. 2005, San Diego, CA

Oral presentation at Western Field Ornithologists conference, Sept. 2005, Santa Maria, CA

Issues/Concerns; changes in research objectives, methods, or products:

A no cost extension was granted to allow time for more in-depth analysis and write-up of data.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of Altering Stand Structure on Wildfire Severity and Effects in the Blacks Mountain Experimental Forest, Cascade Range, California

JFSP Project No.: ?? 03-23-20

Project Location: Blacks Mountain Experimental Forest, Lassen County CA.

Principal Investigators: Martin Ritchie, Bill Oliver, Carl Skinner, Kerry Farris, Steve Zack and Gary Nakamura

Contact Information (Phone, e-mail): 530-226-2551 mritchie@fs.fed.us

Brief Description of Project:

Evaluation of the thinning and prescribed fire effects on wildfire behavior (tree mortality and damage) and effects of varying levels of fire salvage in burned areas for the Cone Fire in northeastern California.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Two manuscripts this year:

Ritchie, M.W., T.A. Hamilton, and C.N. Skinner. In Review. Probability of Wildfire-Induced Tree Mortality in an Interior Pine Forest: Effects of Thinning and Prescribed Fire.

Skinner, CN; Ritchie, MW; Hamilton, T; and Symons, J. In press. Effects of prescribed fire and thinning on wildfire severity: the Cone Fire, Blacks Mountain Experimental Forest. In: S. Cooper, editor. 25th Annual Forest Vegetation Management Conference, January 2004, Univ. of California Cooperative Extension, Redding, CA.

Web site is currently being updated with the most current information and should be completed by October 1.

For the demonstration component of this project, six signs have been placed throughout the cone fire describing both the effects of treatments on the fire and the subsequent studies on salvage and mortality. A main Display has been built and will be put in place this fall.

Numerous field tours have also been given in 2004 and 2005 to groups including Forestry Institute for Teachers, U.C. Biomass For Fuel Reduction Tour, and the Quincy Library Group.

Preliminary data analysis on woodpecker/beetle interactions presented at an Oregon State University Outreach Education conference: "Ponderosa Pine: Management, Issues and Trends".

Issues/Concerns; changes in research objectives, methods, or products:

Because of the rocky soil, bulk density measurements have been difficult and costly to obtain in many of the plots at Blacks Mountain. There may be confounding with rock content so that effects of salvage on soil compaction will either be nil, or difficult to detect.

Also, evaluation of bark beetle/woodpecker interactions has been limited to the strip plots. In our variable-retention salvage units, the one year delay on salvage to complete NEPA means that most of the bark beetle foraging is already complete, so effects on woodpecker foraging will be limited to secondary wood boring insects.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fuels reduction in oak woodlands, shrub lands and grasslands of SW Oregon: Consequences for native plants and invasion by non-native species

JFSP Project No.: 03-3-3-36

Project Location: SW Oregon – Medford District of the BLM

Principal Investigators: Patricia S. Muir and Paul Hosten

Contact Information (Phone, e-mail): Muir: (541) 737-1745

muirp@science.oregonstate.edu; Hosten: (541) 618-2295 paul_hosten@or.blm.gov

Brief Description of Project:

We are assessing the consequences for plant communities of two fuel reduction treatments that are being applied over large acreages in oak woodlands and shrub lands of the Applegate Valley Adaptive Management Area in SW OR, which is managed by the Medford, OR office of the BLM. We use two basic approaches: (1) *Rapid surveys*, which are used to determine relatively coarse-scale distribution and range of conditions of plant communities across the landscape, and (2) *Detailed stand-level monitoring* in permanently marked plots, which allows us to quantify more precisely current conditions of and changes in the plant communities discerned at the landscape level.

For the stand-level work, data are collected in (untreated) plots paired with plots treated with the two primary fuels treatment methods being used in the area: 1) mechanical cutting and mulching of shrubs and small trees “mastication” and 2) hand-cutting of this material followed by piling and burning. Smaller areas have been treated with prescribed fire, and our studies include this treatment as well as an area that experienced recent wildfire. We use a combination of retrospective and prospective approaches, sampling some areas before (and after) treatment and some only after treatment. This allows us to include a range of times since treatment in the design. We focus on consequences for native plant communities, invasion by nonnative species, resultant fuel models, and implications for future fire behavior and effects. In addition, we are monitoring the development of plant communities in areas that have been treated for fuel reduction followed by seeding of native grasses, comparing untreated areas and areas treated for fuel reduction with and without seeding.

Rapid landscape-level surveys are based on analysis of vegetation types and conditions using aerial photographs and ground truthing. Data will be used to determine the current range of plant communities and conditions across the landscape. This information will allow us to create a spatially explicit landscape plant community database to serve as the context for the more detailed stand-level data collection, and against which future changes can be assessed at a relatively coarse scale. Locations of noxious weed populations are recorded with GPS during the landscape surveys.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Two seasons of field work have led to the establishment of paired transects (treated and

untreated) in areas treated with each fuel reduction method.

- Vegetation and fuels have been sampled in approximately 50 such pairs, some of which were sampled also ~ 3 yrs ago.
- Data analysis for this component of the project is underway.
- Vegetation has been sampled in areas that will soon be seeded with native grasses (after fuel reduction treatments were applied), and follow-up sampling will occur in the 2006 field season.
- Vegetation has been sampled at the landscape scale, using extensive walk-throughs of areas identified on aerial photographs.
- Vegetation maps are being prepared at the landscape level.

Deliverables include:

- Yearly annual reports in written and electronic form (one has been completed).
- Papers published in peer-reviewed scientific journals and presentations at scientific meetings and conferences attended by land managers and the interested public (e.g., one seminar on the work has been presented at Oregon State University and another is planned for presentation at the summer 2006 meetings of the Ecological Society of America)
- Data, locations of permanent plots, and GIS maps are archived electronically each year (through the NBII and in the Oregon office of the BLM) and are available for use by others.
- In the upcoming Year 3, we will develop a manual of plant communities, fuel types, recommended fuel treatment prescriptions and rationale, landscape-level planning strategies, and expected vegetation responses (including weed invasion) for use by agencies, scientists and the general public. This manual will be available in paper copy and on line.
- Permanent monitoring plots will serve as demonstration plots for the range of plant community restoration and fire-hazard reduction protocols. Field trips to demonstration plots will be offered to interested groups by the third year of the project.
- An MS thesis by a graduate student at Oregon State University and another by a student at Southern Oregon University are anticipated by June 2006.

Results are expected to yield effective stand-level treatments that reduce fire hazard while simultaneously fostering the restoration of native plant communities, minimizing invasion by exotic species, and allowing for safe reintroduction of fire to the landscape. The work will benefit land managers by providing information on outcomes of the various fuels treatments that will enable them to make informed decisions for future management. Results will also be used to inform the public about the utility of recommended approaches and will contribute to our basic scientific understanding of processes that affect plant and animal communities in these and similar areas.

Issues/Concerns; changes in research objectives, methods, or products:

Grasslands are not included in the detailed stand-level monitoring of fuel reduction treatment effects, as treatments are not occurring in these ecosystems.

The timeline for work was changed, as the start date was delayed until January 2004.

Prescribed fire is used much less widely than the other two fuel reduction treatments, hence less sampling in areas treated with prescribed fire will occur than anticipated. Similarly, post-treatment seeding with native grasses has not, to-date, occurred as widely as anticipated, hence study of its consequences comprises a smaller portion of the work than anticipated.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Spatial Interactions Among Fuels, Wildfire, and Invasive Plants

JFSP Project No.: 00-1-2-01

Project Location: Colorado State University, Western Forest Fire Research Center

Principal Investigators: P. N. Omi, M. A. Kalkhan, E.J. Martinson, G.W. Chong, T.J. Stohlgren

Contact Information (Phone, e-mail): 970-491-5819, Philip.Omi@Colostate.edu

Brief Description of Project:

This project investigated spatial relationships among fuels, wildfire severity, non-native plant invasions, and post-fire fuel flammability in three mixed-conifer forests of the Rocky Mountains of Colorado and New Mexico. We employed a dual approach that involved: (1) assessment of pre-fire stand conditions, burn severity, vegetation (native and exotic species), and post-fire flammability based on samples from multi-scale plots and (2) development of spatial prediction models to extrapolate from plot to landscape scales using remote sensing imagery and existing spatial data layers. We addressed the following questions:

- To what extent is fire severity related to stand conditions?
- Is fire severity a predictor of non-native plant abundance?
- Do disturbances created by pre-fire treatments provide a source for post-fire non-native plant invasions?
- To what extent does risk of post-fire exotic invasion vary with aspect, elevation, and cover type?
- Does post-fire seeding mitigate invasion risk?
- Do invaded areas represent greater post-fire fuel hazard?

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

This project has highlighted some of the ecological risks and benefits associated with pre- and post-fire management activities. Integration of remote sensing, geographic information systems, and field data produced spatial statistical prediction maps; a cost-effective means to identify areas vulnerable to non-native plant species invasion and increased potential for wildfire. We have completed the following activities in support of this project:

- 295 plots sampled from 3 wildfires.
- Databases compiled for variables related to each of the following: stand condition, fire severity, soil condition, plant species composition, and fuel modeling inputs.
- Analyses conducted to predict fire severity, cover of non-native plants, and post-fire flammability at each site.
- 9 presentations delivered at professional conferences attended by land managers.
- 3 papers submitted for publication in peer-reviewed journals.
- 2 papers in preparation for submission to peer-reviewed journals.
- 2 papers published in conference proceedings.
- 2 chapters published in a U.S. Forest Service General Technical Report.
- 1 doctoral dissertation.
- 1 master's thesis.
- 1 website developed for project dissemination.
- Final report delivered to the JFSP Governing Board on May 31, 2005.

Issues/Concerns; changes in research objectives, methods, or products:

This project has concluded.

JFSP 2004 Principal Investigator Workshop

Project Title: Fire and Invasive Annual Grasses in Western Ecosystems 00-1-2-04
Project Location: Great Basin, Mojave Desert, and the southern Sierra Nevada Mountains
Principal Investigators: Matt Brooks, Jayne Belnap, Jon E. Keeley, and Robert Sanford
Contact Information (Phone, e-mail): 702-564-4615, matt_brooks@usgs.gov

Description of Project: This project evaluated the interactions between fire, soil nutrients, and dominance by invasive annual grasses in vegetation types currently dominated or threatened by invasive annual grasses in western North America – specifically great basin sagebrush and yellow pine forest. These two systems have unique features that contribute to the dominance of invasive annual grasses, and elucidation of these will contribute to a broader understanding of the problem.

We used intensive field manipulations at representative sites in these two vegetation types that coupled burning, nutrients, fuels and light treatments. In addition, extensive surveys were conducted the soil nutrient status associated with invaded and non-invaded sites. These field studies were coupled with laboratory studies to examine in detail the relationship between soil heating and nutrient availability for invasive grasses. With this information, managers can determine in advance if habitats are naturally vulnerable or resistant to invasions, enabling limited resources to be more effectively deployed both during and after fires. Fire prescriptions can also be designed to avoid creating conditions susceptible to invasion, plus, restoration techniques could be better targeted, saving both time and money.

Status Report:

Deliverables listed in the proposal that were completed as planned:

- Technical report for land managers within 1 year of project completion.
(We will develop and deliver this during FY06)
- Six scientific publications will be submitted to peer-reviewed journals within 2 years of project completion.
(currently we have 7 peer-reviewed papers published, 4 in press, and 3 in review; plus 11 non-peer-reviewed papers published)
- An annual report will be submitted to the Joint Fire Science Board
(Submitted each year of the project)
- Website
(<http://www.werc.usgs.gov/fire/lv/fireandinvasives>)
- Results will be presented at a minimum of two national and two local scientific meetings, and Joint Fire Science Program workshops.
(37 total presentations between 2002 and 2005)

The project ended, and a final report was submitted at the end of FY05.

Issues/Concerns affecting the project:

Deliverables listed in the proposal that were completed in a revised format:

- Data from this study will be coupled with an NRCS soil survey to create a landscape-level map of post-fire soil susceptibility to invasion for one of the studied regions.
(rather than a map, this information was summarized in a peer-reviewed publication in review with the Journal of Range Management)

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Invasive Plant and Fire Interactions: Use of the Fire Effects Information System to Provide Information for Managers

JFSP Project No.: 00-1-2-09 (PI Ryan), 03-4-2-03 (PI Smith)

Project Location: Fire Sciences Laboratory, Missoula, MT

Principal Investigators: Jane Kapler Smith

Contact Information (Phone, e-mail): 406-329-4805, jsmith09@fs.fed.us

Brief Description of Project: This project is adding information on invasive plant species to the Fire Effects Information System (FEIS). Literature reviews covering a total of 60 nonnative invasive plant species are being added to FEIS or receiving synthesis of new information. Thirty-seven species are covered by completely new reviews; 23 species were previously in the system, so they are receiving a synthesis of new with old information. This task has linked FEIS to other Internet sites with high-quality information on invasive species. In the process of writing species reviews, we have recorded information on knowledge quality and knowledge gaps and are completing a paper that describes the state of our current knowledge about invasive species and fire.

The species reviews produced by this task will improve management decisions regarding fire and nonnative invasive species. The paper describing knowledge gaps will assist scientists and managers in determining research priorities.

Status Report:

Deliverable 1: Produce literature reviews covering 60 species of nonnative invasive plants. As of 8/22/05:

- 50 spp completed & online
- 1 sp in review (online by 8/31/05)
- 9 spp in preparation (8 will be online by 9/30/05, 1 by 10/31/05)

Geographic coverage of species reviewed in this task:

- Northeast/north-central 9
- Atlantic 11
- Southeast 15
- Central/Plains 26
- West 21
- Southwest 21

Deliverable 2: Quantitative analysis of knowledge gaps regarding fire and nonnative invasive species—Methods of analysis were developed and first version completed in 2004, based on the species reviews then complete. The paper will be updated in Sept. 2005 with data from recent species reviews, then submitted for publication.

Issues/Concerns; changes in research objectives, methods, or products:

No issues, no concerns.

Additional product: Poster describing both deliverables will be presented in October 2005 at the 23rd Tall Timbers Fire Ecology Conference: Fire in Grassland and Shrubland Ecosystems.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Evaluating Communication Strategies and Local Partnerships: Methods for reducing fuels, sharing responsibility, and building trust

JFSP Project No.: JFC-33-17

Project Location: Study sites are located in OR, WA, ID, and CA

Principal Investigators: Dr. Bruce Shindler, Dept. of Forest Resources, Oregon State University

Contact Information: (541) 737-3299; Bruce.Shindler@oregonstate.edu

Brief Description of Project:

This study will evaluate the effectiveness of National Fire Plan and Joint Fire Science Program cooperator agency communication strategies as well as partnerships with local organizations for fuel reduction programs. Research will be at the community level where fire personnel have begun to work cooperatively with local jurisdictions and citizen groups to gain acceptance for agency programs and build joint responsibility for fire management activities. Objectives include, 1) identify partnership arrangements and public outreach programs that hold promise as relatively new or innovative techniques; 2) establish cooperative relationships with agency personnel and local partners to allow for monitoring and evaluation of communication activities; 3) design and implement measures to assess program effectiveness and outcomes, including the components that lead to more successful communication among partners, that result in projects being completed on the ground, and those that build trust between agencies and communities; 4) develop a plan for implementing communication strategies that meet management objectives, and 5) conduct interactive workshops in research communities to discuss findings and implications with fire management and outreach personnel.

Status Report :

Research has been conducted or is underway at various Forest Service, BLM, and National Park Service management units. A study design allowing replication is been utilized for comparison across sites. An additional line of questioning has also been developed for each site to provide information relevant to individual locations. Agency cooperation at each site has been outstanding; personnel are enthusiastic about this line of research and are finding initial products useful. Research will continue through 2006 with a particular focus on objectives 4&5.

Deliverables

- Study protocol for expanded replication and evaluation
- Summary reports of quantitative survey findings from study sites
- Summaries of qualitative interviews and focus groups
- DVD production, Communication Strategies for Fire Management : Creating Effective Citizen-Agency Partnerships
- Field guide: A practical guide to citizen-agency partnerships: public outreach strategies for fire and fuel management

Science delivery and application

- Presentation at the District Ranger Summit, USDA Forest Service, Region 6. *Communication Strategies for Collaborative Planning in Forest Communities*. May, 2005, Tacoma, WA.
- Presentation to agency personnel on the Deschutes National Forest. *Building community partnerships*. May, 2005, Sisters, Oregon.
- Shindler, B. and R. Gordon. DVD production released in May, 2005. Communication strategies for fire management: Creating effective citizen-agency partnerships. This is a training tool for fire managers, outreach personnel, and community groups.
- Shindler, B. and R. Gordon. A practical guide to citizen-agency partnerships: public outreach

strategies for fire and fuel management.

- Collaborative workshop with the Colville National Forest and the Northeast Washington Forestry Coalition. January 2005.
- Conducted site tours: One for agency personnel and one citizen tour to demonstration sites on the Willamette National Forest. Discussions of treatment alternatives and outcomes.
- Met with Australian scientists on landcare and fire management in Tasmania, Australia.
- Website – <http://oregonstate.edu/~shindleb/jfsp>.

Published articles

- Toman, E., B. Shindler, and M. Brunson. In Press. Fire and fuel management communications strategies: citizen evaluations of agency outreach programs. *Society and Natural Resources Journal*.
- Shindler, B., J. Hino, and R. Gordon. 2005. Digital video in the classroom: communication skills for future resource professionals. *Journal of Forestry* 103(1):41-46.
- Shindler, B. In press. Public acceptance of wildland fire conditions and fuel reduction practices: challenges for federal forest managers. In: *Humans, Fires, and Forests: Social Science Applied to Fire Management*, T. Daniel (ed.). Corvallis, OR: OSU Press.
- Toman, E., B. Shindler, and M. Reed. 2004. Prescribed fire: the influence of site visits on citizen attitudes. *Journal of Environmental Education* 35(3):13-18.

Journal articles and General Technical Report chapters currently in progress

- Shindler, B., E. Toman, and S. McCaffrey. Fire risk and fuel management practices in the Great Lakes region: an examination of public attitudes.
- Shindler, B., E. Toman, C. Olsen, and C. Kakoyannis. Communicating in post-fire environments: Lessons from agency-citizen tours of a wildland fire.
- Toman, E. and B. Shindler. Communicating the wildland fire message: Influences on knowledge and attitude change.
- Toman, E. and B. Shindler. Wildland fire and fuel management: Principles for effective communication. For USDA Forest Service, N C Research Station General Technical Report.

Implications

- Public support is a basic requirement to fuel reduction project implementation.
- Education and outreach are effective tools for changing public attitudes and influencing behaviors about fuels management.
- Both unidirectional and interactive communication methods have a role in fire management. Unidirectional (one-way) programs can help build public awareness of problems and interactive activities can more directly educate and instruct citizens about fuel management behaviors and help build trust among participants.
- Resource professionals have limited resources to dedicate to the outreach and communication job, and are in need of practical materials and training.
- This research is helping identify and prioritize the elements of successful communication strategies so that agency personnel can adapt them to their own situations and communities.

Issues/Concerns; changes in research objectives, methods, or products:

Establishing research sites was slow to evolve as we were dependent on management units first having public outreach programs underway for evaluative purposes. Now that places and programs have been identified, data are being collected and products are forthcoming. Objectives 4&5 will be accomplished during 2006.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: In-Woods Decision Making of Utilization Opportunities to Lower Costs of Fire Hazard Reduction Treatments

JFSP Project No.: 01-1-2-03

Project Location: Flagstaff, AZ

Principal Investigators: Eini Lowell, Robert Rummer, Debra Larson, Dennis Becker

Contact Information (Phone, e-mail): Lowell 503-808-2072 elowell@fs.fed.us

Brief Description of Project: The project was designed to evaluate the feasibility of using in-woods decision making for utilization opportunities to lower the cost of fuels reduction treatments. Four 20-acre blocks on Forest Service land under contract were chosen at 2 sites on the Coconino National Forest. The initial stand conditions and marked treatments provided a range of piece sizes and stocking conditions. Two harvesting systems (cut-to-length, whole tree) were applied to blocks and different slash treatments (in-woods vs. roadside) were applied within blocks. Elemental time and motion study documented productivity of all harvesting operations. A sub-sample of trees was selected for processing using a MicroMill. Product volume (quantity) and value (quality) were determined. MicroMill productivity was also assessed. Pre- and post-fuels surveys were conducted on all sites. Productivity information was incorporated into a Windows-based, public domain engineering software program called the Harvest Cost-Revenue (**HCR**) **Estimator**. The HCR Estimator is used to evaluate stand-level economic thresholds for harvesting small diameter ponderosa pine given various product markets. The model allows forest planners to conduct project appraisal, set minimum contract bid rates, and assess the stumpage value of material removed. Contractors can use the model to estimate operation and maintenance costs of selected equipment and generate detailed cost estimates for project bidding. Others are able to use the model to estimate project costs in assisting business expansion, development, and economic development. Additional project information can be found at our website available through the PNW Research Station (<http://www.fs.fed.us/pnw/sev/esp/ESP-JFSP.htm>).

Status Report: The HCR Estimator has been expanded in the past year to include additional user-specified functions. Science delivery was enhanced with the addition of workshops and expanded one-on-one training and outreach. Collaboration continues with logging contractors and regional agency representatives to identify potential users, assess capabilities, and customize the model to meet specific needs. To date we have accomplished the following:

Decision-Support Tools

- Harvest Cost-Revenue (HCR) Estimator, public domain software available Fall 2005 on CD-ROM

Model Trainings and Outreach

- Workshops were held in the spring of 2005 in Flagstaff and Show Low, AZ, Ruidoso, MN, and Durango, CO to Beta-test the HCR Estimator model and to train users. Participants included federal agency representatives, state forest planners, tribal foresters, logging contractors, wood-manufacturing businesses, consulting foresters, and non-profit organizations (~75 people).
- Federal agency representatives included Forest Service, BIA, and BLM forest planners, contract specialists, district rangers, and Regional Office (R2, R3) planners.
- One-on-one trainings and consultations on the application of the HCR Estimator (~50 people)

Presentations & Posters

- 9 Local and regional presentations (Fall '02 – Spring '05) (~390 people)
- 7 National presentations (Winter '02 – Spring '05) (~450 people)

Publications

- Economic assessment of using a mobile MicroMill for processing small diameter ponderosa pine (PNW-GTR-623, December 2004)
- The Harvest Cost-Revenue (HCR) Estimator for southwestern Ponderosa Pine: CD-Rom and User's Manual (PNW-GTR-XXX, anticipated Fall 2005)

- Matching forest thinning opportunities and community development with public land managers' responsibilities (NC-GTR-XXX, anticipated Winter 2005)
- Comparing costs and benefits in policy decisions regarding small wood utilization using the HCR Estimator (*Forest Science*, anticipated submission Winter 2005)
- Matching the utilization of forest fuel reduction by-products to community development opportunities, In *People, Fire, and Forests* (Oregon State Press, anticipated Spring 2006)
- Evolution of sustainable communities and sustainable forests: The paradox of small wood utilization, In *Advances in Community research and natural resources* (Kluwer Academic Publications, anticipated Summer 2006)

Key Partners

- Greater Flagstaff Forests Partnership
- Four Corners Sustainable Forests Partnership/ Southwest Sustainable Forests Partnership
- Colorado Wood Utilization & Marketing Program
- Arizona Sustainable Forests Partnership
- Northern Arizona Wood Products Association
- Skyline Forest Resources, Escalante, UT
- Northern Arizona University
- Region 3, National Forest System
- Region 1/4, National Forest System
- Rocky Mountain Research Station
- Southern Research Station
- Pacific Northwest Research Station
- Joint Fire Science Program

Issues/Concerns; changes in research objectives, methods, or products: Project Completed

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: A national study of the economic impacts of biomass removals to mitigate wildfire damages on federal, state, and private lands (Economics of Biomass Removals Study)

JFSP Project No.: 01-1-2-09

Project Location: Nationwide

Principal Investigators: Karen L. Abt and Jeffrey P. Prestemon

Contact Information (Phone, e-mail): 919-549-4094 kabt@fs.fed.us; 919-549-4033

jprestemon@fs.fed.us

Brief Description of Project: This research evaluates the impacts of large-scale mechanical stand density reduction, and supports decision making by land managers undertaking programs of wildfire risk reduction. We calculate the economic consequences of fire-related biomass removals from public lands on public and private timber producers and timber demanding firms inside and outside of biomass treatment zones. We have assembled information on (a) biomass removals cost and wood outputs; (b) forest inventory, timber product output, and timber demand by sector; and (c) wood product supply and demand relationships nationwide. Alternative government policies are compared by fire risk reduction achieved and timber market impacts. Risk reduction and market impacts are evaluated across regions, time, and product categories.

Status Report

Research status:

- Developed treatment alternatives to reduce stand level wildfire risk in conjunction with Wood Utilization Opportunity Areas Project and Fuel Treatment Evaluator (PI: Ken Skog).
- Bio-economic spatial-equilibrium model development includes southern and western states, all treatment alternatives, mill types and locations, temporal optimization.
- Treatment costs are being developed for specific treatments, forest types, and residual volumes.

Delivery and application:

2005 Accomplishments:

- Presentations: (a) Huggett, R.J. Jr., J.P. Prestemon, K.L. Abt. 2005. Timber market impacts resulting from mechanical fuel treatments. IFORS, Honolulu, Hawaii. June 2005. Following all at Southern Forest Economics Workshop, April 2005, Baton Rouge, LA. (b) Ince, P.J., H.N. Spelter, M. Alderman, J. Ronca, I. Durbak, J.P. Prestemon. 2005. Economics of biomass removals-West model. (c) Prestemon, J.P., R.J. Huggett, Jr., K.L. Abt. The market economics of mechanical fuel treatments. (d) R.J. Huggett, K.L. Abt, K.E. Skog, W.D. Shepperd, E. Reihhardt, J. Barbour, P. Miles. Mechanical fuel treatments in the Western United States and their Impact on wildfire hazard ratings. (e) K.L. Abt, J.P. Prestemon and R.J. Huggett, Jr. Market impact of fuel treatment subsidies for fire hazard reduction in the Southern and Western US. (f) Arriagada, R. F.W. Cubbage, K.L. Abt. Estimating timber harvesting costs for forest fuel reduction treatments in the west.
- Mill location maps have been completed and are available at <http://www.srs.fs.usda.gov/econ/data/datatool.htm>
- Abt, K.L. and J.P. Prestemon. 2005. Timber Markets and Fuel treatments in the Western U.S. Natural Resource Modeling (refereed).

Planned:

- Presentations at 2005 SAF and 2005 Silviculture conferences.
- Preparation of a special issue for Forest Policy and Economics Journal, which will include 4 to 6 papers from this project.
- Presentations to regional and national fire and fuels specialists.

Management implications:

- Marginal treatment costs (costs per acre) and welfare costs of programs increase with larger programs, U.S. consumers (mills) gain but non-participant producers(private timber growers) lose
- Constraining the program to high-risk stands raises marginal cost of the program but reduces the negative impacts on non-participants
- Currently, the government is mechanically treating fewer than 200,000 ac/yr and removing products that amount to 0.1% of U.S. harvests from only 36,000 ac in FY 2003
- An increase in program removals may require additional administrative capacity at national forests.
- Treatment of all at-risk stands will require more than 30 years with a \$300 million per year program
- Some stands will revert to high-risk status and should have retreatment even before all stands have been treated once.

Issues/Concerns; changes in research objectives, methods, or products:

- Developed consistent, defensible treatments for broad-scale planning application to FIA inventory plots west-wide.
- Used torching and crowning indices rather than condition class to evaluate plot-level fire risk. Also allows us to project treatment return intervals and regrowth.
- Incorporated the southern US into the spatial equilibrium model.
- Developed a multiyear model which allows flexibility and evaluation of long run sustainability to accomplish the goals of the healthy forests initiative.
- Unknowns: (a) measures of fire risk are unavailable for the south (b) relationship of torching and crowning indices to risk of damages from fire (c) differences in treatment costs for stands in the wildland urban interface

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Impacts of Prescribed Burning on the Survival of Douglas-fir and Ponderosa Pine in the Boise National Forest

JFSP Project No.: BLM 02IA-11046000-034 018-3-2-01

Project Location: Boise National Forest

Principal Investigators:

Robert Progar (PNW Research Station Corvallis, OR) rprogar@fs.fed.us 541.750.7374

Kathy Geier-Hayes (Boise National Forest) kgeierhayes@fs.fed.us 208.373.4315

Tom Jackson (Emmett RD) tsjackson@fs.fed.us 208.365.7025

Tammy Cook (Emmett RD) tcook@fs.fed.us 208.365.7015

Description of Project:

Our study examines the relationship between fuels, prescribed fire, fire caused tree injury, and primary and secondary mortality over a three-year period. We have established 800 individual tree plots (400 Douglas-fir and 400 ponderosa pine) in four study blocks that have been/or will be burned with prescribed fire. Plot diameter is correlated with tree dbh and established to encompass the rooting zone of the tree. All fuels have been measured on each individual plot tree. Fire severity is being measured on each plot tree. ANOVA and regression analysis will be used to evaluate the relationship of fuel consumed to tree mortality over a three-year period after fire. The results will provide needed information to land managers who are asking similar questions throughout the Intermountain Region.

Status Report:

Four hundred of the plots were burned in 2002. We have collected pre- and post burn fuels and fire severity data on all 400 of these plots for 2002 and 2003, 2004 and will make the final data collection in August 2005 on all burned trees. Approximately 60% of the plots were exposed to fire leaving 40% as comparison plots. Burn conditions on the remaining 400 plots have not been attained in 2003, 2004 or 2005. To evaluate impacts on small/fine roots and mycorrhizae we collected soil cores from a stratified sample of 15% of our plots. A graduate student completed a MS degree in December 2003 with a thesis study that evaluated the impacts of prescribed fire on fine roots/mycorrhizae on our treated plots.

Issues/Concerns; changes in research objectives, methods, or products:

Cooperators from the Boise National Forest are to meet in the near future to reaffirm the feasibility of getting prescribed fire on our remaining 400 plots. The Boise National Forest is in strong support of completing the study. The weather has been uncooperative in obtaining a burn window during the past three years. We need to recollect fuels data on these plots since the current data is three years old. We are planning to recollect the fuels data in the early spring of 2006.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Managing Fuels in Northeastern Barrens

JFSP Project No.: 01C-3-1-05

Project Location: Cape Cod, Martha's Vineyard, Montague, Massachusetts; Long Island, New York

Principal Investigators: W.A. Patterson III, David W. Crary, Jr.

Contact Information: wap@forwild.umass.edu, david_crary@nps.gov

Brief Description of Project: Fire-dependent barrens of the Northeast are important habitat for several rare, threatened, and endangered plant and insect species. They also represent the most dangerous wildland fuel type in the region and pose a significant wildland-urban interface risk in this densely populated area. We have established four demonstration sites in Massachusetts and New York State where barrens fuels are managed using combinations of overstory thinning, mechanical treatment of shrub fuels, sheep grazing and prescribed fire to reduce fuel loads, wildfire intensity, and wildland-urban interface risk. We have targeted the general public and land managers of the region with interpretive signs, brochures, guided walks, a website, and two symposia. We assessed the effectiveness of combined treatments (e.g., mowing plus burning, thinning plus grazing) in reducing fuel loads and fire intensity. Our work builds on a 20-year study examining individual treatments (mowing or burning during the dormant or growing seasons with treatments at 1-, 2-, 3- or 4-year intervals) in barrens vegetation at Cape Cod National Seashore (CCNS). We have taken advantage of new work at Martha's Vineyard and Montague, MA and on Long Island, NY to evaluate methods for altering fuel bed structure while maintaining barrens attributes associated with rare species habitats; and have developed, tested, and refined custom fuel models for both unaltered and managed barrens fuels. Our results are applicable to barrens fuels on federal, state, and private lands throughout the Northeast.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

The project is in its final year. We have:

- Conducted a week-long field trip for 45 managers and scientists in June 2004 and a custom fuel modeling workshop for 20 practitioners in March 2005.
- Added a fourth demonstration site – in the Suffolk County (Long Island, NY) pine barrens with National Fire Plan funding to and in cooperation with the Long Island Chapter of The Nature Conservancy and New York State Dept. of Environmental Management.
- Developed a web-site (<http://www.umass.edu/nrc/nebarrensfuels/>) describing work on regional sites.
- Four graduate students have completed their work with a journal article in press and three oral presentations accepted for the Tall Timbers Fire Ecology Conference in October.

Between now and September 2006 we will:

- Print brochures describing the Martha's Vineyard and CCNS work.
- Work with The Nature Conservancy to document and interpret for managers and the public the work on Long Island.

- Conduct a third symposium/workshop.
- Continue to refine and update our web site (which is receiving positive reviews and contributions from visitors).
- Implement plans for maintaining demonstration sites.
- Continue to prepare work for publication.

Issues/Concerns; changes in research objectives, methods, or products: We requested and received an extension to August 2006 to complete additional work not covered by our original proposal. No additional funding was requested.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: "Effects of fire on Kuenzler's hedgehog cactus (*Echinocereous fendleri* var. *kuenzleri*)"

JFSP Project No.: 01C-3-3-12

Project Location: Texas Tech University

Principal Investigators: David B. Wester and Carlton M. Britton

Contact Information (Phone, e-mail): 806 742 2843 (david.wester@ttu.edu)

Brief Description of Project: This project is designed to study the effects of prescribed fire on Kuenzler's hedgehog cactus, a threatened and endangered species that grows in the mountains of central New Mexico. Little is known about the effects of fire on this species. Two areas with cacti populations, one near Fort Stanton, NM and one west of Carlsbad, NM, will be studied. The initial plans for this project were to burn plants in two seasons ("early"—late March; and "late"—mid June) in the field and to also conduct a burn barrel study. The basic design of the study is to relate fire response to fuel load and fuel arrangement at the micro-site level around burned plants.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

This project had a delayed start because of difficulties in acquiring adequate permits for burning an endangered species. We have located in the field several thousand individual plants at the Fort Stanton study area; the Guadalupe Mts. study area has only several hundred plants. Initial permits from the USFWS allowed us to burn 5% of plants at each study area. In June, 2004, we burned 13 plants in the Guadalupe Mt. study area; we have monitored plant response since the time of burn. To date, none of the 13 burned plants have died. Unusually wet conditions prevented us from burning at the Ft. Stanton study area in March, 2004, and a burn ban prevented burning in June, 2004. Because of these circumstances, we decided that for burning in 2005 at the Ft. Stanton study area, we would take the first opportunity for appropriate conditions, and burn all permitted plants. Thus, in spring, 2005, we burned 96 plants at the Ft. Stanton study area; an additional 96 plants act as controls and are being monitored as well. Each plant is being monitored for response to burning. To date, 4 plants in the burned treatment have died (two of these evidently because of animal consumption), and 6 plants in the control treatment have died (two evidently by accidental human disturbance). The summer of 2005 has been devoted to developing and calibrating a burn barrel study so that plant response to carefully-controlled conditions can be modeled. This portion of the study will utilize 200 plants that were purchased from a local nursery. These plants have been transplanted into clay pots and currently are established and thriving under greenhouse conditions. We have sought for, and received, permits to burn an additional 100 plants under field conditions at Ft. Stanton; these plants will be burned under burn barrel conditions after calibration issues have been resolved. At this time, burning is anticipated in spring or summer of 2006

Issues/Concerns; changes in research objectives, methods, or products:

None to report at this time.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Characterizing Moisture Regimes for Assessing Fuel Availability in North Carolina Vegetation Communities

JFSP Project No.: 01C-3-3-21

Project Location: North Carolina, South Carolina, Southeastern Virginia, Eastern Tennessee

Principal Investigators: Roberta A. Bartlette, James J. Reardon, Gary M. Curcio

Contact Information (Phone, e-mail): (406) 329-4828, rbartlette@fs.fed.us

Brief Description of Project: Address local knowledge gaps in characterizing soil and live fuel moisture trends in North Carolina vegetation complexes that are of significant concern to fire management plan development and implementation. This multi year field project directly measures moisture contents in live and dead surface fuels, root mat/duff and organic/mineral soils in coastal plain and upland piedmont and mountain sites. Water table wells quantify moisture gradients within deep organic soils and moisture sensors instrument both organic and mineral soils. Daily weather and radiometric measurements collected from representative weather stations will be used to estimate midday dead fuel moisture contents and potential evapotranspiration. Vegetation greenness will be monitored using satellite remote sensing. Understanding yearly moisture trends in the live fuel/soil complex will identify fuel availability within these vegetation types. Sampled and remotely sensed data will be displayed through the study via a website. The best methods for monitoring fuel availability will be identified and shared with fire managers through publications and workshops.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Accomplished (previous year)

- Trained cooperators and 2 field technicians in the use of datalogging equipment and the proper techniques of fuel moisture sampling and analysis.
- Installed soil moisture and temperature monitoring equipment, at 30 sampling sites. Automated water table wells were installed on 12 sites. Collected soil moisture, water table depth, soil temperature and live and dead moisture data from the sampling sites during the last 11 months and will continue through August 2007.
- Data from our Fort Bragg site was used to support modeling efforts to predict ozone emission from prescribed burning. This research is currently being conducted by MSE Technology Applications, Butte, MT.
- Results were presented at The EastFIRE Conference, 05/11-13/2005- "*Methods for Characterizing Moisture Regimes for Assessing Fuel Availability Pocosin, Sand Hills and Appalachian Vegetation Communities*"

Planned (next 6 months)

- Reestablish 3 damaged sample sites, continue sampling on the balance of the sites.
- A web site to present current results from all sites is currently under construction.
- Present a preliminary analysis of current data to our cooperators at meeting with cooperators (11/2005)
- Planned presentation of preliminary analysis at the Onslow Bight Fire Manager meeting in N.C.(11/08). This meeting is being conducted by the Nature Conservancy in support of the National Landfire Project.

Issues/Concerns; changes in research objectives, methods, or products:

Hurricanes, extremely wet weather and wildlife have respectively destroyed roads leading to sites, delayed sampling schedules and dismantled data logging equipment and sensors. Lost sites will be re-established this autumn. The sampling schedule has been adjusted to allow flexibility. Equipment redesign is offering better protection from wildlife. Objectives and planned products remain unaltered.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Relationships of an Alien Plant, Fuel Dynamics, Fire Weather and Unprecedented Wildfires in Hawaiian Rain Forests: Implications for Fire Management at Hawaii Volcanoes National Park

JFSP Project No.: 03-3-3-15

Project Location: Hawaii Volcanoes National Park

Principal Investigators: J.B. Kauffman, R.K. Loh, R.F. Hughes, and J.T. Tunison

Contact Information (Phone, e-mail): 808-933-8121 ext 101 boonekauffman@fs.fed.us

Brief Description of Project:

In April, 2004 we began a comprehensive research project to quantify vegetation and fuels responses to wildfires in subtropical moist and wet forest communities of Hawaii Volcanoes National Park. All research work was conducted in and around forests burned by the Kupukupu (burned 2002) and the Panauiki, and Luhi fires (burned 2003). These wildland fires were ignited by lava flows during extended dry periods. Virtually all areas burned were stand-replacing. We are quantifying fire effects on vegetation and the vegetation response as well as fuel loads, fuel moisture dynamics, and in-stand microclimate conditions across a steep climatic/elevational/vegetation gradient. This gradient includes 5 distinct plant communities and fuel types ranging from grasslands dominated by exotic grasses and scaly sword fern (*Nephrolepis multiflora*) at lower elevations to wet forests of native trees (Ohia – *Meterosideros polymorpha*) and tree-ferns at higher elevations. In each community, we are sampling unburned controls, once-burned, and twice-burned communities. We are measuring responses of both native and alien species and communities to single and multiple fires. We are relating changes in fuel loads and microclimate to changes in plant composition and diversity. Microclimate and fuels data are important to know if, and to what magnitude, fuels and microclimate feedbacks are facilitating frequent fire and hence creating a barrier to native forest recovery. We will use the above empirical measures to determine potential fire behavior under invaded and un-invaded scenarios as well as in pre-and post –fire conditions of each scenario using the BEHAVE program.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

In each community and treatment that we sampled, we established five replicate 20 x 50 m permanent plots using a completely randomized design. Sites were selected based on elevation, fire history, composition and structure, and proximity to unburned sites. Vegetation was stratified by life form (trees, shrubs, herbaceous layer) and measured using a nested plot design one and two years following fire. Presence/absence and cover data will be used to calculate species richness, abundance, and diversity. Shrub mortality was quantified from plot density data. To determine whether species present on the landscape survived fire or established following fire, live individuals were categorized as seedling, resprout, or unburned. Shrub maturity (sign of reproductive parts) was recorded. Quantitative measures for all trees in each plot included diameter at breast height, number of stems or boles/ha, crown mortality, plant mortality, and mode of sprouting. From these data, percent crown mortality and complete plant death will be estimated for all trees by species, and by size class for each species.

Biomass of both live and dead trees is being determined using allometric equations where dbh is the dependent variable. Surface fuels (litter, duff and herbaceous vegetation) were sampled in 8-50 x 50 cm microplots within each sampling unit. Downed wood debris was sampled using the planar intercept technique. This is the first study to parameterize the planar intercept technique for Hawaiian forests by collecting the average diameter and specific gravity of the downed wood particles. These measures will be combined with the estimates of tree biomass to examine differences in total aboveground biomass present in various community types and to measure changes in biomass quantities and accumulation rates. To collect necessary data to model potential fire behavior, portable weather stations were installed to record temperature, relative humidity and wind speed.

Preliminary results indicate that many native species in this region possess adaptations that allow them to survive a single burn through either individual sprouting or seedling establishment in the post-burn environment. Despite the near complete mortality of the forested canopy by fire (i.e., over 99% of the dominant trees top killed), over half of these trees sprouted one year following fire. In addition to native species, many alien species also possess adaptations that promote survival following fire. We documented increases in alien species richness and cover one year following fire for all communities. These increases in alien species abundance have the potential to alter the successional trajectory of these forested communities. Forested sites that burned in 2002 and reburned in 2003 had significantly reduced survivorship of the dominant tree species for all size classes. Multiple burns in rapid succession are detrimental to these native forest communities.

In Summary we have found that:

- Native Hawaiian plant species in this region possess a suite of diverse adaptations that facilitate survival and/or establishment following fire.
- Alien plant species increased in abundance one year following fire.
- Alien plant species have the potential to alter the successional trajectory of these mesic and wet forest communities.
- Multiple fires in rapid succession are detrimental to the survival of native species; this is particularly true in these forest which likely have very long fire-return intervals.

Preliminary results were presented at two professional meetings in 2005. At the Hawaii Conservation Conference PI Rhonda Loh and graduate student Ali Ainsworth delivered linked presentations on the science and management applications following fire in these rare tropical forests. Ainsworth presentation was received an award as the best science presentation by a student. Results were also presented in the fire and vegetation dynamics session at the Ecological Society of America 2005 annual meeting. Research results were also presented at the 2004 California-Nevada-Hawaii Fire Council meeting.

Issues/Concerns; changes in research objectives, methods, or products: The fact that there were 2 additional wildland fires that burned the study area after we had written the original proposal but before it was funded, changed and broadened the scope of the project. We now are able to examine vegetation and fuels response to areas burned twice and compare them to sites burned only once.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of season of prescribed fire and grazing on understory plant communities in a ponderosa pine forest.

JFSP Project No.: 03-3-3-28

Project Location: Southern Blue Mountains, Malheur NF, Oregon

Principal Investigators: Becky K. Kerns and Walter G. Thies

Contact Information (Phone, e-mail): Kerns: 541-750-7497; bkerns@fs.fed.us

Brief Description of Project:

The concept that native biodiversity is likely to benefit from restoration of natural processes is a central tenet of ecological restoration and ecological management frameworks. Fire has functioned historically as a key disturbance agent in forest ecosystems, and there is broad consensus that controlled fire reintroduction is urgently needed in western dry forests. However, prescribed fires now interact with environment conditions that are very different than historical conditions. Fire is being returned to landscapes where exotic plants are often present, native species may have tenuous or declining populations, native seed banks may be lacking, and tree densities and fuel loading are excessive. Much of this forest type is also used for livestock grazing. A critical question is how prescribed fire and grazing impact understory plant communities and exotic species. To address this issue, we established randomly located grazing exclosures in 4 eastern Oregon ponderosa pine stands scheduled for 5-year interval prescribed fire reburns. Our objectives were to examine herbaceous response to the reburns with and without cattle grazing. Vegetation and environmental data were sampled from 0.03 ha exclosures prior to and for 2 years after the reburns from the following randomly applied treatments: no burn no grazing, no burn grazing, spring reburn no grazing, spring reburn grazing, fall reburn no grazing, fall reburn grazing. Three grazing exclosures that excluded cattle but were accessible to other grazers were built in each treatment.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Understory vegetation was measured in 2002 prior to the 5-year reburns in all stands.
- Cattle exclosures were built in 2002.
- The 5-year reburns were successfully completed in October 2002, and spring 2003.
- Understory vegetation was measured in 2003 and 2004.
- Three years of data have been entered, cleaned and are currently being analyzed.
- Preliminary results were presented at the international ESA/INTECOL meeting in Montreal, Canada in August, 2005.
- Management implications:
 - 2 years after 5-year prescribed fire reburns, there was no significant difference in native plant species richness or abundance although native short-lived ruderals increased in abundance on fall burn areas as did exotic species cover.
 - Cattle grazing significantly reduced total plant cover, forb cover, sedge cover, and grass height.
 - No difference in species composition based on cattle grazing was detected, but season of burn, burn severity, litter extent and accumulation were significantly related to species composition.
 - Expectations that prescribed fires will increase native perennial plant richness and abundance in ponderosa pine forests may not be met. The synergist effect of prescribed fire and cattle grazing may actually lead to reduced plant cover, especially for native perennials, and increases in exotic invasive weed species.

This project proceeded largely as planned in the original proposal. However, the majority of tech transfer efforts will be postponed until FY06 because Kerns was reassigned in FY05 to act as the Interim Assistant Director of the Western Wildland Environmental Threat Assessment Center.

This project proceeded largely as planned in the original proposal. However, the majority of tech transfer efforts will be postponed until FY06 because Kerns was reassigned in FY05 to act as the Interim Assistant Director of the Western Wildland Environmental Threat Assessment Center.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Invasive Plant and Fire Interactions: Use of the Fire Effects Information System to Provide Information for Managers

JFSP Project No.: 00-1-2-09 (PI Ryan), 03-4-2-03 (PI Smith)

Project Location: Fire Sciences Laboratory, Missoula, MT

Principal Investigators: Jane Kapler Smith

Contact Information (Phone, e-mail): 406-329-4805, jsmith09@fs.fed.us

Brief Description of Project: This project is adding information on invasive plant species to the Fire Effects Information System (FEIS). Literature reviews covering a total of 60 nonnative invasive plant species are being added to FEIS or receiving synthesis of new information. Thirty-seven species are covered by completely new reviews; 23 species were previously in the system, so they are receiving a synthesis of new with old information. This task has linked FEIS to other Internet sites with high-quality information on invasive species. In the process of writing species reviews, we have recorded information on knowledge quality and knowledge gaps and are completing a paper that describes the state of our current knowledge about invasive species and fire.

The species reviews produced by this task will improve management decisions regarding fire and nonnative invasive species. The paper describing knowledge gaps will assist scientists and managers in determining research priorities.

Status Report:

Deliverable 1: Produce literature reviews covering 60 species of nonnative invasive plants. As of 8/22/05:

- 50 spp completed & online
- 1 sp in review (online by 8/31/05)
- 9 spp in preparation (8 will be online by 9/30/05, 1 by 10/31/05)

Geographic coverage of species reviewed in this task:

- | | |
|---------------------------|----|
| • Northeast/north-central | 9 |
| • Atlantic | 11 |
| • Southeast | 15 |
| • Central/Plains | 26 |
| • West | 21 |
| • Southwest | 21 |

Deliverable 2: Quantitative analysis of knowledge gaps regarding fire and nonnative invasive species—Methods of analysis were developed and first version completed in 2004, based on the species reviews then complete. The paper will be updated in Sept. 2005 with data from recent species reviews, then submitted for publication.

Issues/Concerns; changes in research objectives, methods, or products:

No issues, no concerns.

Additional product: Poster describing both deliverables will be presented in October 2005 at the 23rd Tall Timbers Fire Ecology Conference: Fire in Grassland and Shrubland Ecosystems.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Strengthening Applications of the Ventilation Climate Information System (VCIS) for Multiple-Scale Planning, Documentation, and Risk Assessment

JFSP Project No.: 03-4-2-05

Project Location: Seattle, WA

Principal Investigators: Jeanne Hoadley*, Sue A. Ferguson, and Narasimhan (Sim) Lakin

Contact Information (Phone, e-mail): 206-732-7867, jhoadley@fs.fed.us

Brief Description of Project: The Ventilation Climate Information System (VCIS) is one of few landscape tools for evaluating and documenting the probability of potential smoke impacts. This project is implementing user-identified improvements to the data and web-access system, creating on-line tutorials for specific tasks such as documentation, planning, and assessment at local to regional scales, and developing lesson plans and workshops to facilitate training.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Planning workshop with collaborators - complete
- Web access to raw model output - partially complete, further refinements planned
- Development of new statistics including annual time series – complete not yet installed
- Development of user defined thresholds and probabilities - in progress
- hiring in progress for staff to complete website improvements
- development of lesson plan - 75% complete
- development of tutorial awaiting completion of web and ArcIMS improvements
- recalculation of planetary boundary layer – not yet begun
- engineering of new hardware - complete
- reengineering of web and database servers was begun but stalled by personnel changes
- query options on geographic and political layers – awaiting completion of ArcIMS upgrade
- overlay maps of non-attainment areas and improved layers – hiring student to complet

Issues/Concerns; changes in research objectives, methods, or products:

Due to unexpected personnel and leadership changes we are about six months behind on this project and will likely need to request an unfunded extension to July of 2006

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: *A Regional Information Node for Fire Science in the Pacific Northwest* (named the Northwest Fire Research Clearinghouse [FIREHouse]) **and** *Expanding FIREHouse (the Northwest Fire Research Clearinghouse) to Alaska* (<http://www.fs.fed.us/pnw/fera/firehouse/index.html>)

JFSP Project No.: 03-4-2-06 and 05-4-2-03

Project Location: Seattle, WA

Principal Investigators: 03-4-2-06: David L. Peterson and Jennifer Pollock

05-4-2-03: Diana Olson, David L. Peterson, Jennifer Pollock, and Jennifer Allen

Contact Information (Phone, e-mail): Diana Olson, dloolson@fs.fed.us

Brief Description of Project:

The goal of the Northwest Fire Research Clearinghouse (FIREHouse) is to provide user-friendly, web-based documentation and data on fire science and technology relevant to Washington, Oregon and Idaho. Additionally, in 2005, the JFSP granted funding to FIREHouse to expand to Alaska (05-4-2-03).

At a minimum, FIREHouse is targeting projects funded by the JFSP and the National Fire Plan (NFP), although it currently includes projects funded outside of these sources, and will continue to add non-JFSP/NFP project information. For each project posted, the goal is to provide, as applicable, online, searchable access to: 1) project and tool descriptions, contact information and links; 2) online publications; 3) proposals and study plans; and 4) metadata. When possible, the web pages describing projects and management tools include a section devoted to technology transfer and applications in resource management, as well as an educational component that uses common language and graphics to explain important findings. FIREHouse also offers server space, web and database support for researchers who choose to post their primary data on FIREHouse. In addition to adding fire research information specific to Alaska to the main FIREHouse website, the project extending FIREHouse to Alaska (05-4-2-03) will provide two substantial deliverables: 1) the development of an online map interface displaying fire-effects plot metadata in Alaska; and 2) the advancement of the Alaska Fire Reference Database by converting it into an online, searchable bibliographic database.

By making information about Northwest and Alaska fire research more accessible, FIREHouse will help fuel management programs meet their goals. FIREHouse is a collaboration between the Fire and Environmental Research Applications Team (FERA) of the USDA Forest Service Pacific Northwest Research Station, Pacific Wildland Fire Sciences Laboratory; the University of Washington; the National Park Service; the Bureau of Land Management-Alaska Fire Service; and the National Biological Information Infrastructure (NBII). FIREHouse is coordinating efforts with the Fire Research and Management Exchange System (FRAMES) project team.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

As of August 19, 2005, web postings have been created and made publicly available on FIREHouse for 42 projects and 38 sub-projects, representing 42 JFSP-funded proposals, 5 NFP-funded proposals, and 14 other projects not funded by the JFSP or NFP. Additionally, web postings have been created for another 38 projects and 48 sub-projects (representing 24 JFSP-funded proposals, 5 NFP-funded proposals, and 9 otherwise-funded projects). These additionally postings are not yet available to the public because they either are pending review by the relevant researchers, or have not been submitted for review to the relevant researchers. Between the publicly and privately posted web pages, FIREHouse has posted links to 85 websites, has posted or linked to 102 publications (and 6 publication lists) and 24 proposals, and has developed 11 fact sheets (and linked to 31 external fact sheets, or comparable documents). By the end of the original FIREHouse project funding (03-4-2-06 – expiring the end of December 2005), we plan to make the private postings public, and to post information for at

least 38 more JFSP- or NFP-funded projects (some of which were funded in 2004 and 2005) relevant to the Northwest.

To date, FIREHouse has been presented at the JFSP 2004 Principal Investigator Workshop, poster presentations have been made at the 2004 NBII All Node Meeting and at the 2005 IUFRO Transfer of Forest Science Knowledge and Technology Conference, and the FIREHouse website itself was on display at the Wildland Fire 2005 Conference. A poster will also be presented at the October 2005 NBII All Node Meeting, and we plan to make some sort of presentation at both the Alaska Annual Fall Fire Review in October 2005 and the Northwest Fuels Meeting in November 2005. The website will also be highlighted in the "Websites on Fire" section of an upcoming issue of Fire Management Today.

Specific to the Alaska extension of FIREHouse (05-4-2-03), interagency agreements have been initiated with the NBII and the Alaska Fire Service. A draft database shell for the Alaska fire-effects plot metadata has been completed, and the first (very draft) version of the Alaska Fire Reference Database should be available online sometime in September 2005.

Issues/Concerns; changes in research objectives, methods, or products:

The first round of JFSP funding for FIREHouse expires at the end of the 2005 calendar year. By that point we are confident that we will have posted information about most, if not all, of the 81 Northwest JFSP- and NFP-funded projects we originally targeted (as well as additional JFSP projects that have been funded since 2003 and non-JFSP or NFP projects). We expect to begin a crosswalk between FIREHouse and FRAMES (or straight from FIREHouse to NBII, if necessary) during FY2006, as a precursor to the eventual merging of the two projects. However, FIREHouse will remain an independent website throughout the duration of the 05-4-2-03 funding (i.e., mid-November 2006), and longer if necessary. This crosswalk with FRAMES (or NBII) will make the information posted on FIREHouse available as more formalized metadata records through NBII, in addition to information's current availability through the user-friendly interface on FIREHouse.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: A national study of the consequences of fire and fire surrogate treatments, and Supplement to the fire surrogate study: Interdisciplinary and multi-site analysis

JFSP Project Nos.: 99-S-1 and 04-S-02

Project Location: USDA Forest Service PNW Research Station, La Grande Lab

Principal Investigators: Phil Weatherspoon and James McIver

Contact Information (Phone, e-mail): Phone: 541-562-5129, ext. 35; Email: james.mciver@oregonstate.edu

Brief Description of Project:

The Fire and Fire Surrogate Study is a national research project implemented on forested land at 13 sites located in 9 states. The primary objective of the study is to quantify the initial effects (first five years) of fire and fire surrogate treatments on a number of core response variables within the general groupings of **(a)** vegetation, **(b)** fuel and fire behavior, **(c)** soils and forest floor characteristics (including relation to local hydrology), **(d)** wildlife, **(e)** entomology, **(f)** pathology, and **(g)** treatment costs and utilization as they vary across geographically isolated sites. Each response variable was measured prior to treatment and for 4 years after the treatments were implemented.

The 4 treatments include: **1)** Untreated control, **2)** Prescribed fire only, **3)** Mechanical fuel treatment only, and **4)** Mechanical treatment followed by fire. The 4 treatments will be applied at each site (except the Sequoia National Park Site, which will have only control and burn-only treatments); at all sites, each treatment will be replicated three times on a 25-acre area.

Sites include: Mission Ck -- mixed conifer, C Wash; Hungry Bob -- ponderosa pine, NE OR; Lubrecht -- mixed conifer, W MT; S. Cascades--mixed conifer, N CA; Blodgett -- mixed conifer, C CA; Sequoia -- mixed conifer, S CA; SW Plateau -- ponderosa pine, N AZ; Jemez Mts. -- mixed conifer, N New Mexico; Ohio Hills -- oak/hickory, S OH; Southern Appalachian Mts. -- oak/hickory, W NC; SE Piedmont -- pine hardwood, W SC; Solon Dixon -- longleaf pine, S AL; and Myakka Park -- slash pine, W FA.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Treatments have been implemented at 12 of the 13 sites (Jemez Mts. is due to finish implementation by the end of calendar year 2006. All post-treatment data for 12 sites has been collected and entered in site-level databases. Network database is nearly complete now for fuels and vegetation, with pre- and post-treatment data completely validated for 10 sites for fuels and 12 sites for vegetation. Soils, entomology, and pathology data are currently in validation process.

Site-level analysis of initial results is largely completed for 10 of the 12 finished sites. Results have been reported in several ways: 1) several hundred presentations have been given at local, regional, and national level conferences, meetings, and workshops; 2) a total of 71 papers have been published so far (37 Proceedings/GTRs; 21 Theses/Dissertations; and 13 Refereed Journal Papers); 3) all published information is now accessible on our web site (www.fs.fed.us/ffs). Network level analysis is just getting underway -- we have just hired a post-doc to analysis network level fuels, vegetation, entomology and pathology data; we will soon hire an analyst for soils; economics and wildlife analyses are underway with current

personnel. We anticipate being ready to present network level results toward the end of calendar year 2006, at a national fire conference.

FFS personnel will soon offer 4 regional workshops to higher level management personnel, in an effort to demonstrate the high value of FFS experimental information on effects of fuel reduction treatments. Workshops will be held in September at Lubrecht (W MT), in November at Blodgett (C CA), and later at Ohio Hills hardwood site and the Solon Dixon longleaf site. Each workshop will illustrate the kind of information that we have available, and where it can be found, and will solicit comments on how the information can best be packaged.

Issues/Concerns; changes in research objectives, methods, or products:

Biggest issue is the efficacy of technology transfer, or how to compete with the massive amount of information that is currently available on natural resource issues. The regional workshops should help us here, to identify other methods of getting our information into the hands of managers who most want and need it.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: A novel approach to regional fuel mapping: linking inventory plots with satellite imagery and GIS databases using the Gradient Nearest Neighbor method

JFSP Project No.: 01-1-4-09

Project Location: ecoregions in northeastern Washington, coastal Oregon, and California Sierra Nevada

Principal Investigators: Janet L. Ohmann, PNW Res. Stn., USDA Forest Service; Michael C. Wimberly, Warnell School of Forest Resources, Univ. of Georgia; Jeremy S. Fried, PNW Res. Stn., USDA Forest Service.

Contact Information: phone (541) 750-7487, fax (541) 758-7760, e-mail johmann@fs.fed.us

Brief Description of Project: This project involves mapping vegetation and fuels in the Western US using the Gradient Nearest Neighbor (GNN) method. The GNN method uses multivariate statistics to link ground data, satellite imagery, and GIS maps of environmental variables. A suite of fine-scale plot variables is imputed to each pixel in a digital map, allowing simultaneous and consistent predicting of a wide range of vegetation attributes. Vegetation plot data are maintained at the finest level of resolution, allowing production of maps that portray a wide array of summary variables and classifications. We examined the utility of GNN for predicting fuel patterns in contrasting forest ecosystems of coastal Oregon, northeastern Washington, and the California Sierra Nevada. The GNN maps can be useful for assessing fire risk, planning fuel management, and modeling the behavior and effects of prescribed burns and wildfires.

Status Report: This study is on schedule to conclude on 30 September 2005. Status is summarized below.

Plot databases for vegetation and fuels variables. We've developed standardized relational databases in Access for field plots on all ownerships for all study areas, and metadata are now being prepared. Plots are primarily from regional forest inventories, and from research and fire monitoring plots for National Parks. The plot databases contain site, vegetation, and fuels variables (surface and canopy attributes, stylized fuel models). We are now developing crosswalks from our data to XML schema for assigning fuelbed prototypes of the Fuels Characterization Classification System.

Spatial databases. Standardized GIS grids needed for GNN model input have been developed for all areas, and metadata are being prepared, for the following: mosaicked Landsat TM imagery for the year(s) best matching plot dates (TM bands, Tasseled Cap transformations, band-ratios, texture indices); climatic indices derived from Daymet; topographic measures derived from digital elevation models; ownership class; location (easting and northing); and mapped disturbances where available (timber harvests, fires, insect and disease mortality).

GNN models, maps, and accuracy assessments. We've completed GNN models, maps, and accuracy assessments for all study areas. In all areas, forest structure was most strongly associated with Landsat variables, and species composition was linked to environment, especially climate. Map accuracy was better overall in Oregon than in Washington or California, where we are revising imagery in hopes of improving accuracy. Accuracy generally was best for variables describing canopy structure and forest development. Fuel variables that are neither directly sensed via Landsat imagery nor strongly correlated with overstory characteristics (e.g., 10-hr fuels) were difficult to predict, but plot data and accuracy assessment for these variables is problematic in regional mapping. Even where site-level accuracy was poor, the GNN maps well represent regional distributions and range of variability.

Technology transfer and applications:

- We visited the Washington study area in 2003 and California in 2004. We met with collaborators, clients, and local experts to learn about the ecology and management of each area, and to better understand needs and applications for vegetation and fuels maps. The visits resulted in several adjustments to our models, and identification of several potential clients for our maps.
- We developed software for GNN imputation mapping. A beta version was presented at a software swap meet and has been distributed to several users. Version 1.0 will be released by project end.
- Research findings have been presented at several professional society meetings and in one proceedings paper. A manuscript for a refereed journal will be completed by project end.
- A website for communicating research methods, data, and findings, and for distributing products, is under development and will 'go live' at the conclusion of our project.
- Digital maps, documentation of data and methods, and accuracy assessments have been provided by request as products become available, and final versions will be distributed from our website.

Issues/Concerns; changes in research objectives, methods, or products: none.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: DEVELOPING STATISTICAL WILDLIFE HABITAT RELATIONSHIPS FOR ASSESSING CUMULATIVE EFFECTS OF FUELS TREATMENTS

JFSP Project No.: 0828 01-1-3-27

Project Location: Bonners Ferry Ranger District, Idaho Panhandle National Forest

Principal Investigators: Kevin S. McKelvey, Leonard F. Ruggiero, Barry Bollenbacher, Fred Samson, Yvette Ortega

Contact Information (Phone, e-mail): Sam Cushman, 406 329 2133; scushman@fs.fed.us

Brief Description of Project: The primary weakness in our current ability to evaluate future landscapes in terms of wildlife lies in the lack of quantitative models linking wildlife to forest stand conditions, including fuels treatments. This project focuses on 1) developing statistical wildlife habitat relationships models (WHR) utilizing Forest Inventory and Analysis (FIA) and National Vegetation Pilot data augmented with specific wildlife sampling at plot locations, and 2) to collect matching data in areas where fuels manipulation and reduction treatments have been applied. Coupled with forest growth models, statistical WHR are being used to estimate habitat occupancy on future landscapes that include extensive fuels treatments. The statistical nature of these models will allow the power of derived cumulative effects understandings to be evaluated. As an additional benefit, for select species we will directly relate abundance-based metrics with presence/absence data to determine the efficacy of using presence/absence data to assess abundance.

Status Report

Summer 2003 and 2004 – Animal Sampling on National Vegetation Pilot Grid

We surveyed the National Vegetation Pilot Grid in the Bonners Ferry Ranger District of the Idaho Panhandle National Forest and an additional 31 plots in stands that had received fuels reduction treatments for terrestrial mammals, including bears, lynx, fisher, marten ungulates, lagomorphs, rodents and insectivores, as well as reptiles and amphibians. Approximately 330 National Vegetation Pilot Plots were surveyed for small mammals (four consecutive nights), snowshoe hare, ungulates, bears, reptiles and amphibians.

Winter 2003 and 2004 – Hair Snare Survey of Mid-sized Carnivores in the Northern Selkirk Mountains

In a collaborative effort between the University of Idaho, Idaho Department of Fish and Game, Idaho Panhandle National Forests, and the Rocky Mountain Research Station, we conducted extensive hair snare surveys for fisher and marten in the Northern Selkirk Mountains. In 2004, we set a total of 186 hair snares set in 18 hydrological basins in the Priest River and Kootenai watersheds. From this sampling effort we identified 20 samples from fisher, from three sub-basins in the Selkirk mountains. Several of these samples had a haplotype that indicates that native fishers persisted in the Selkirk Mountains, which is a finding of substantial management and conservation importance. A total of 22 American marten samples were also identified. In 2005, we expanded the survey to areas not included in the 2004 effort. The 2005 analysis indicated fisher present in three additional watersheds on the Priest River side (west) of the Selkirk Mountains. The sampling identified wolverine and many marten samples as well.

Data Analysis and Modeling

We have recently obtained funding from USFS Region 1 and the FIA program to complete the

data analysis portion of the project over the next three years. We anticipate that we will be able to produce rigorous multi-scale habitat relationships models for at least 15 species of terrestrial mammals. These models will describe the relationships between the occurrence or abundance of these species and habitat factors at a range of spatial scales, using hierarchical variance decomposition techniques to quantify the independent and interactive effects of different ecological conditions across a range of spatial scale, from local microhabitat to broad-scale landscape conditions. These models will be very useful for understanding the ecology of these species, how they are likely to be influenced by various natural and anthropogenic perturbations. We will use the models to infer the expected impacts of particular future management and fire regimes through linkage with dynamic landscape simulation models. Dr. Cushman recently gave an invited talk at the 9th International Mammalogical Congress in Japan on the modeling approach we have developed for this analysis.

We are also developing species-specific models of gene flow and habitat connectivity from the genetic data we collected from each sampled animal. We have genetic samples from over 10,000 small mammals, several hundred black bears, dozens of martens and several fisher and wolverines. We have completed the analysis of black bear landscape genetics in the study area, and Dr. Cushman recently presented the results at the 9th International Mammalogical Congress in Japan. In the black bear landscape genetic analysis, we compared the actual pattern of genetic differentiation with 110 different hypotheses of landscape resistance to identify the landscape factors that are most related to gene flow of this species in our study area. The resulting connectivity map is unique in its empirical rigor and its utility to evaluate land management and landscape change effects on habitat connectivity for a native wildlife species. We are presently working on proposals to fund the analysis of several additional species' gene flow across the study area. Our study has produced the largest sample to date of genetic material across a large landscape grid for 15 species. This enables us to model a number of very important landscape-genetic processes, such as gene flow, dispersal ability, and identify conduits, corridors and barriers to movement for the different species.

We will also analyze the effects of fuels treatments on the occurrence or abundance of wildlife, using factorial ANOVA. These analyses will provide a quantitative measure of the stand- and landscape-level impacts wide-spread fuels treatments are likely to have on the occurrence and abundance of terrestrial mammals in the inland Pacific Northwest.

Issues/Concerns; changes in research objectives, methods, or products:

We are developing several additional research projects that will augment and extend the current multi-species monitoring efforts. First, we have draft proposals to expand the current work by adding sampling birds, bats and moths to the species sampled. Birds, bats and moths are very important taxa for this multi-species monitoring effort due to their sensitivities to ecological conditions, frequent use as indicator taxa, and their likely vulnerability to climate change. We will also expand our modeling study by linking the empirical models of species-habitat relationships to multivariate gradient imputation to infer habitat suitability across the landscape for each species. Next we will use landscape dynamic simulation models, such as RMLands to simulate expected landscape changes under alternative future management, climate and fire regimes, and use our empirical habitat relationships models to predict the effects of these perturbations.

Second, we are working with the Western Mountain Initiative to gather data on our study grid to support analysis of the relationships between climate, fire and forest ecology. This project will sample micro-climatological and edaphic conditions, such as daily humidity, daily

temperature, April snow pack, and soil depth, on each National Vegetation Pilot plot. This will allow us to directly link vegetation and animal community structure to the key ecological drivers of energy, temperature and water. Most community ecology studies have been limited by the fact that they merely correlate occurrence of one set of species to occurrence to habitat pattern, without reference to ecological drivers, processes or mechanisms. The proposed work will provide direct linkage with temperature, solar radiation, snow pack, soils, and topography. These are the key factors that limit essential resources, and thus drive the patterns of community structure. This will provide an unprecedented integration up the ecological hierarchy from the level of abiotic resources to the responses of the plant and animal communities. This is very exciting and has never been done on a large forested landscape.

Third, we are developing a proposal to fund the analysis of the genetic samples we have collected from our study grid. This will enable us to model how genetic dissimilarity changes as a function of distance, topography, and habitat type for a number of species. This will enable us to provide a rigorous test of movement models (such as those Sam Cushman is developing for R1), as well as allowing us to quantify the relative resistance of different landscape elements, singly and in combination, to movement of a wide range of species. It will also allow us to quantify how spatial heterogeneity in habitat quality and traversability influence natural selection, gene flow and genetic drift, by studying the effects of elevational gradients and topography on natural selection of the albumin locus in deer mice. These landscape genetic projects have the potential to provide major insights into how spatial pattern and heterogeneity influence population genetics, which has immense implications for conservation biology and basic ecological theory.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of Fire on Biological Soil Crusts and Their Subsequent Recovery in Pinyon-Juniper

JFSP Project No.: 01-3-3-34

Project Location: Western USA

Principal Investigators: Steve Warren, Paul Kugrens, Larry St.Clair

Contact Information (Phone, e-mail): 970-491-7478, swarren@cemml.colostate.edu

Brief Description of Project: The original intent was to determine the nature and extent of damage to biological soil crust communities by documenting changes in their cover, biomass, species composition and ecosystem function after a prescribed burn in the pinyon-juniper ecosystem. Given the circumstances noted below in the section on Issues/Concerns, it is likely we will have to abandon the idea of using a prescribed burn and shift to a wildfire location. Recovery dynamics will be monitored for 2 years.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): The project is currently restarting given reasons explained in the Issues/Concerns section.

Issues/Concerns; changes in research objectives, methods, or products: Using our own funds, we established pre-burn plots near Austin, Nevada in 2001. Funds for the project arrived 2 years late, in 2003, long after the prescribed burn that was to be used in the study. We located another site administered by the BLM in the Book Cliffs of southern Utah, and established pre-burn plots in 2004. Due to the presence of geologic surveying crews during the fire season, the burn could not be accomplished, and it is doubtful if it will be burned in the foreseeable future. Given the problems encountered to date, we have tentatively decided to abandon the idea of using a prescribed burn. It is our intent to find the location of a recent wildfire in the pinyon-juniper ecosystem and use an adjacent unburned area as the control. We have identified several such sites, but they did not have a good biological soil crust in the pre-burn condition. We continue to search for prescribed burn sites and/or wildfire sites that meet the needs of the project. The scope of work will change only marginally. The only significant change is the substitution of an adjacent unburned site to represent the pre-burn condition.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of Mechanically Generated Slash Particle Size on Prescribed Fire Behavior and Subsequent Vegetation Effects

JFSP Project No.: 03-3-2-06

Project Location: Okanogan-Wenatchee NFs, Methow Valley RD

Principal Investigators: Dr. Richy J. Harrod, Dr. David W. Peterson, Roger Ottmar

Contact Information (Phone, e-mail): 509-664-9331, rharrod@fs.fed.us

Brief Description of Project: The current administrative study is designed to assess mechanical fuels treatment of non-merchantable trees with mastication equipment. We use an experimental design to quantify relationships among mastication effort, different sized activity fuels resulting from different mastication effort, fire behavior, fire effects, soil effects, and vegetation response. We test the effectiveness of different mastication efforts on fire behavior and potential soil impacts in replicated dense stands of ponderosa pine and Douglas-fir within the Okanogan-Wenatchee National Forests. Fuels are measured utilizing standard methods at grid points, vegetation is measured in four plots per stand, soil organic matter and nutrient availability are measured at grid points, and production rates and costs will be determined for each replicated stand. The results of the study will be used to provide a management-oriented guide for developing thinning prescriptions using mastication systems and the subsequent prescribed burning. In addition, scientific publications will be published describing effects of mastication thinning and burning on fuels and fire behavior, forest vegetation, soils, and economics. The results of the study will be applicable to current management strategies on the Okanogan-Wenatchee National Forests as well as other Forests throughout that are managing dry forest vegetation.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Pre-treatment data have been collected on all experimental units.
- Contracts under the stewardship authority are currently being developed for implementation of mastication treatments.
- Prescribed burn plans are currently being developed for post-mastication burning.
- Web site has been developed and will be updated as new information becomes available (<http://www.fs.fed.us/r6/wenatchee/ffs-mastication/>).

Issues/Concerns; changes in research objectives, methods, or products:

Shortly after receiving the JFSP agreement for this project, the Okanogan-Wenatchee NFs soil scientist retired and funding for the soil portion of the study was virtually eliminated. Soil sampling procedures are being modified slightly and the Wenatchee Forest Sciences Laboratory is assisting with funding and expertise. Updates to methods and expected products will be described in subsequent updates.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of Prescribed and Wildland Fire on Aquatic Ecosystems in Western Forests
JFSP Project No.: 01-1-3-12

Project Location: Idaho: Krassel RD-Payette NF; Montana: Sula RD-Bitterroot NF; Oregon: Applegate RD-Rogue NF, Grayback Mtn-Siskiyou NF, Grants Pass Resource Area-Medford BLM.

Principal Investigators: David S. Pilliod, R. Bruce Bury, and P. Steve Corn

Contact Information (Phone, e-mail): 805-756-2207, dpilliod@calpoly.edu

Brief Description of Project: The goal of the project is to understand how fire in upland and riparian forests influence stream communities and whether prescription burning mimics the ecological function of fire in a watershed. The project has two components: wildland fire and prescribed fire. To document the range of biotic and abiotic responses to wildland fires, we are comparing stream communities and habitat conditions in watersheds that burned, at varying intensities, to streams in unburned forests (fires absent for 50-70 yrs). To determine whether prescription burning restores the "ecological integrity" of forests, we are monitoring stream communities and habitat conditions before and after spring and fall aerial-ignition broadcast burns and comparing observed responses to unburned and wildfire-burned reference streams during the same time periods. Responses by amphibians, macroinvertebrates, periphyton, and habitat conditions are correlated with burn severity across each watershed. Analyses are focusing on comparisons among streams within local regions.

Status Report:

1. The wildland fire component of this project is currently in the analysis and publication phase.
2. The prescribed fire component of this project is ongoing.

- 9 streams have been monitored since 2001

	Number Streams	Pre-fire data	Year of Rx Burn	Post-fire data	Stream Names
Prescribed Burn - Spring	2	2001-03	2004	2004-06	Parks, Reegan
Prescribed Burn – Fall	3	2001-05	2005	2006	Deadman, Fitsum NF, Williams
Controls	4	2001-06	Not Burned	Not Burned	Blackmare, Buckhorn NF&WF, Fitsum, FourMile

- In summer 2005, under funding provided by a grant from the USGS Fire Science Program, we continued to monitor the post-fire responses of amphibians, macroinvertebrates, periphyton, and habitat conditions in 9 streams.
- Remaining funding from JFSP will be used from September 2005 – September 2006 to complete the post-fire assessment of the prescribed burns, including laboratory and field work.

3. Science Delivery

- To date, we have given 6 presentations to local fire managers, 14 presentations at scientific meetings, organized and hosted 2 workshops, produced 2 reports, and published 4 peer-reviewed articles. We plan to produce 2 additional peer-reviewed journal articles.
- For more information visit the project web site at:
<http://leopold.wilderness.net/research/fprojects/F003.htm>
- A final report and CD-ROM will be available by 1 October 2006.

Issues/Concerns; changes in research objectives, methods, or products: None

JFSP 2005 Principal Investigator Workshop

Project Title: Evaluate sensitivities of burn-severity mapping algorithms for different ecosystems and fire histories in the United States 01-1-4-12

Project Location: USGS EROS Data Center, Sioux Falls, SD, 57198

Principal Investigators: Zhiliang Zhu and Carl Key, USGS

Contact Information (Phone, e-mail): 605-594-6131, zhu@usgs.gov

Description of Project: This research effort is designed to investigate effectiveness of burn severity mapping, using differenced Normalized Burn Ratio (dNBR) for ecosystem monitoring at the 30m scale. The hypothesis of our research is that the differenced normalized burn ratio, calibrated and validated using post-fire ground data (Composite Burn Index, or CBI), can perform consistently for difference climate/vegetation regions and faithfully for new as well as old burns. The research is being conducted on burns located on public lands in most regions of the country, including boreal, western arid, western mountain conifer, and eastern humid ecosystems. CBI data collection is supported through generous assistance by the NPS personnel.

Status Report:

Progress: We were granted by the JFSP a one-year extension at no additional cost. The final report will be submitted by May 2006. To date, fieldwork has covered 81 fires with 2,597 CBI plots collected in 63 datasets. On mapping of burn severity, we have developed at least 65 distinct dNBR datasets that cover those fires. At times multiple fires occurred on one dNBR, while more than one dNBR was developed for some fires, including 18 cases with both Initial and Extended Assessments.

Publications/presentations:

Key, C.H. 2005. *Remote sensing sensitivity to fire severity and fire recovery*. In J. de la Riva and E. Chuvieco, eds. 2005. Proceedings of the 5th International Workshop on remote sensing and GIS applications to forest fire management: fire effects assessment, University of Zaragoza, Spain - Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) - European Association of Remote Sensing Laboratories (EARSeL) Special Interest Group on Forest Fires (FF-SIG) - European Commission (Joint Research Centre). ISBN: 84-96214-52-4:29-39.

December 2004: presented research progress and discussed the potential of integrating dNBR measurements of burn severity with LANDFIRE baseline data. Interagency group in Tucson, AZ.

August 2005: prospects of national dNBR mapping for fire monitoring. Presentation to the Executive Oversight Committee meeting for LANDFIRE in Sioux Falls, SD

Technology transfer:

September 04: CBI and dNBR training in Montana given to NPS employees

May 05: CBI and dNBR training in Montana given to Canadian Forest Service scientists.

October 2004: FIREMON training in Montana

February 2005: Fire in Ecosystem Management, Tucson at National Fire Institute (NAFRI)

April 05: Rx510 - Applied Fire Effects, Tucson at National Fire Institute (NAFRI)

January 05: Rx310 - Introduction to Fire Effects, Boise at NIFC

May 05: the WFLC decided to conduct a national interagency project assessing trends in burn severity between 1982 and 2010 using the dNBR technique. The JFSP research project is the science basis of this national project.

Issues/Concerns affecting the project:

None

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire and Fuels Extension (FFE) to the Forest Vegetation Simulator (FVS):
Completion of Calibration for Eastern Forests, Provisions for User Training,
And Program Maintenance

JFSP Project No.: 01-1-7-07

Project Location: Fort Collins, CO

Principal Investigators: Gary Dixon, Nicholas Crookston, Elizabeth Reinhardt, and
Ralph Johnson

Contact Information (Phone, e-mail): Gary Dixon, (970) 295-5774, gdixon01@fs.fed.us

Brief Description of Project: The FFE-FVS has proven to be a valuable tool for forest managers. This project provides for: (1) a full range of training for field personnel where the FFE-FVS is operational; (2) full support for the computer code; (3) expanding the applicability of the FFE-FVS to portions of the eastern United States; and (4) testing and validation of existing FFE modules.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): All of the original deliverables were completed by summer 2004. A no-cost extension to 12/31/05 was granted by the JFSP Board so the project could achieve additional tasks using existing funding. Summary by task area:

(1) Training: In FY 2003, 7 regional update workshops (FVS trainings with FFE integrated) were held. In addition, 10 3-day new user FFE training sessions were held. In FY 2004 and 2005, 16 additional FVS trainings with FFE fully integrated were held. In total, approximately 600 people have been trained in FFE thru these sessions. FFE support is also available through the FVS hotline. A 10-minute movie about FFE was created. It is currently available on CD and is posted to the FVS website.

(2) Code Support: Since the start of the project, approximately 55 code changes have been made to fix bugs and make improvements to FFE. Seven new variants with FFE included were put into production (northern California, inland California, west cascades, pacific northwest coast, southern, expanded north Idaho, and expanded southern Oregon). Recent improvements include the incorporation of the 40 new fuel models, the ability to export all FFE output directly to a database, and more flexibility when simulating fires.

(3) Eastern Expansion: After a pre-work trip in July 2002, a development workshop was held in November 2002 to gather information on how to calibrate FFE for the Ozark/Ouachita Mountains region. The necessary code work was completed and the southern region FFE was released in the fall of 2003. In December 2003, a workshop was held in Russellville, AR to train local resource managers on use of FFE and to obtain their feedback. After introductory meetings in MI, MN, and WI, a development workshop was held to calibrate the Lake States FFE model in April 2005 in Grand Rapids, MN. The necessary code work is being completed and a fall 2005 release date for LS-FFE is anticipated.

(4) Testing and Validation: Four separate FFE validation workshops have been held in Vallejo, Missoula, Fort Collins, and Bend. Current users suggested model additions and ways to improve some of the regional defaults (for example, the default decay rates and fuel model logic). Additional testing and validation was accomplished through fuel project assistance. Members of the FVS staff assisted with 23 projects, helping local users with FFE simulations

and obtaining feedback in the process. Suggestions from these sessions and the trainings help determine future model improvements. This project also funded additional decay research at Oregon State University, which has been completed. Additional planned work: Results from the research done at OSU and from a coarse woody dynamics model developed by the Forest Service will be used to improve snag and decay relationships throughout the Pacific Northwest FFE variants. Also, ways to initialize surface fuel loadings using photoseries or the FCCS system will be added.

Issues/Concerns; changes in research objectives, methods, or products: None

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire Regimes and Successional Dynamics of Yellow Pine (*Pinus*) Stands in the Central Appalachian Mountains

JFSP Project No.:

Project Location: George Washington & Jefferson National Forests

Principal Investigators: Charles W. Lafon, Henri Grissino-Mayer 010-3-3-09

Contact Information (Phone, e-mail): (979) 862-3677, clafon@geog.tamu.edu

Brief Description of Project: Yellow pine stands in the Appalachian Mountains are fire-dependent. Fire-exclusion appears to be preventing the establishment and maintenance of pines. Resource managers are reintroducing fire in an attempt to restore the stands and reduce hazardous fuel loads, but little research on Appalachian fire regimes is available to guide these fire-restoration efforts. We are using dendrochronological techniques to date fire scars and assess the frequency, seasonality, spatial extent, and climatic relations of fires during the past 300 years. We are analyzing tree age structure and forest composition to elucidate the influences of fire (and fire suppression) on pine establishment, pine maintenance, and the encroachment of hardwood trees and shrubs.

Our primary findings are that prior to fire-suppression efforts, fires occurred at frequent intervals, typically one to five years. Most would have been mild surface fires, occurring primarily during the dormant season (fall or spring). Pines were established throughout the period of frequent burning, but apparently few hardwoods survived in this fire regime. Under fire exclusion, a dense stand of pines, hardwood trees (mostly oaks), and ericaceous shrubs developed. However, because of the crowded conditions, little tree reproduction is occurring at present. Restoring these stands will require the reintroduction of fire at frequent intervals; one challenge in restoring these stands will be to eliminate the shrubs.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

(1) Efforts accomplished:

- Sampling at seven study sites
- Invited research presentations at four workshops for federal fire managers
- Invited research presentations at three colleges or universities
- Eight paper or poster presentations at professional meetings
- One peer-reviewed journal article accepted

(2) Ongoing efforts

- Sampling one additional study site
- Sampling two additional study sites funded by The Nature Conservancy and the National Science Foundation
- Two Ph.D. dissertations and a related M.S. thesis (funded by The Nature Conservancy)
- Three journal articles in progress

(3) Planned efforts

- Several additional journal articles
- Several research presentations
- Organization of a special session on Appalachian fire regimes at the Third International Fire Ecology and Management Congress in 2006

Issues/Concerns; changes in research objectives, methods, or products:

The only concern we have encountered was the termination of our project on Aug. 15, 2005, which was three years from the JFSP award date, but only two years into our research. The cooperative agreement with the George Washington and Jefferson National Forests was not established until 2003, and terminates on Sept. 30, 2006. To deal with this concern, JFSP decided to extend our project deadline to Sept. 30, 2006.

The project, including student research, is proceeding well. The samples we have collected are better than we expected to find and have allowed us to piece together a longer and more useful record of fire than we anticipated initially. We have made a change in research methods that will improve the quality of the final product. Specifically, we decided to sample more thoroughly the age structure and species composition at each of our study sites.

This change is permitting a better understanding of successional dynamics and how they are affected by changes in the fire regime. The tradeoff is that we will not be able to sample as many sites as we might have otherwise, but the improved understanding of the relationship between fire history and vegetation succession makes this effort worthwhile.

JFSP 2005 Principal Investigator Workshop

Project Title: Fire History of Forests in the Peninsula and Transverse Mountains of Southern California

JFSP Project No.: 01B-3-3-18

Project Location: Cleveland, San Bernardino, Angeles, and Los Padres National Forests in southern California.

Principal Investigators: C. Skinner, S. Stephens, M. Borchert, R. Hawkins, M. Dietrich, D. Feser, P. Pontes.

Contact Information: Phone 530-226-2554, e-mail cskinner@fs.fed.us

Description of Project: Some have hypothesized that forest fires in the southern California mountains may have been of relatively high severity and more infrequent than other pine dominated ecosystems of the West. A dendrochronology based fire history study in this region will provide strong evidence to help support or refute this hypothesis. Important related questions are: Should managers design fire management plans to incorporate relatively infrequent (25-40 years), moderate-high severity fires or should they include frequent (5-15 years), low-moderate intensity fires? In which season should fire be prescribed? At present it is not possible to answer these questions.

The objective of this project is to collect, crossdate, and analyze fire history information from the Cleveland, San Bernardino, Angeles, and Los Padres National Forests in southern California. The interaction of climate and past fires will also be examined. Information from this study can assist in development of fire management and forest plans that will be revised in response to the Southern California Mountains and Foothills Assessment.

Status Report:

- During 2003 extensive forest surveys via aircraft, vehicle, and by foot took place within suitable mixed conifer forests over the San Bernardino NF, eastern portions of the Angeles NF, and eastern portions of the Cleveland NF.
- Using a crew of three, field sampling based on these surveys was performed at four different sites in the SBNF from June through December, resulting in the collection of over 200 fire-scarred samples. Over 400 additional samples have been identified and located using GPS for possible future collection. Collected materials have been processed and stored, and are ready for transport to UC Berkeley facilities for crossdating. GIS mapping of collected materials has begun. Collection continues in areas of interest in the SBNF.
- The possibility of correlating FSD records to vegetation at Air Quality Vegetation plots throughout the San Bernardino Mts was explored with Scott Stephens and Joe McBride (both UC Berkeley) during August.
- A systematic grid has been established at the Black Mountain site (SBNF) to test grid-based FSD methodologies against more traditional FSD methods.
- Materials from the Black Mountain site collected prior to the initiation of this project (Skinner & Regelbrugge) were re-located to UC Berkeley facilities for crossdating.
- Additional sampling has been completed for the Angeles, Cleveland, and Los Padres NFs.
- Processing and crossdating of fire scar samples is underway and expected to be completed by December 2005, analysis of data and preparation of final report is planned for winter and spring of 2006.

Issues/Concerns affecting the project:

- None. With the one-year, no-cost extension granted we are on track to complete the project in the specified time.

JFSP 2005 Principal Investigator Workshop

Project Title: Frequency and Season of Prescription Fires to Reduce Hazardous Fuel Loads on the Lower Piedmont of Georgia: Establishing a demonstration area on a 12 year old study.

JFSP Project No.: 01B-3-1-05

Project Location: Hitchiti Experimental Forest near Macon, GA.

Principal Investigators: Kenneth W. Outcalt

Contact Information (Phone, e-mail): 706-559-4309, koutcalt@fs.fed.us

Description of Project: In 1989 a study to quantify the long-term response to various return intervals of dormant- and growing- season prescription fires was installed on the Hitchiti Experimental Forest in Jones CO. Georgia, about 20 miles NE of Macon. The study is comprised of 6 treatments (2-yr winter strip headfire, 3-yr winter strip headfire, 3-yr winter strip backfire, 3-yr summer strip headfire, 6-yr summer strip headfire, and unburned check) replicated 4 times in a randomized block design. This is one of only a handful of such studies in the South and the only one that I am aware of in either mixed pine/hardwood or in the Piedmont Physiographic Province.

The objectives of this demonstration were:

- 1) To influence public opinion about the benefits of frequent low intensity prescription fire versus fire exclusion.
- 2) To document and summarize changes in fuels after 12 years of underburning.
- 3) To conduct breeding season bird point counts.

Status Report: Funding for this project was received in June 2002. A steering committee was established to direct and review content of the web page and display boards. Signs for the individual treatment plots have been made and installed. The web site was completed and launched in January 2004. The structure that holds the display board and site maps was constructed in the summer of 2003 and the poster was installed. A complete vegetation survey was completed each fall of 2002 to 2005. Data for objective 2 has been analyzed and was included on the web and display. The breeding bird survey was conducted in 2003 and 2004.

There was a group tour of the plots in March 2003 for Society for Ecological Restoration – Coastal Plains Chapter. Numerous individuals from across the country have viewed the on site display which is located adjacent to the parking lot for a popular hiking trail. A poster presentation was made at 13 Biennial Southern Silvicultural Research Conference in 2005.

Major Findings:

- None of the burning regimes affected overstory pine or hardwood basal area.
- Even infrequent burns, greatly reduce the understory hardwood component, thereby curtailing succession.
- Different burn regimes can be applied to allow conversion to hardwoods, i.e. no burning, maintaining a mixture, or when combined with mechanical hardwood removal, creating an open pine stand.

Issues/Concerns affecting the project: Initiation of the study was delayed by wildfire restraints in 2002 and the retirement of Dale Wade, original PI. Because of this a 1 year no cost extension was requested and granted in 2005.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fuel reduction effects on a key Sierra food web

JFSP Project No.: 8217 018-3-3-05

Project Location: Teakettle Experimental Forest, Sierra National Forest, Fresno Co., CA and Yosemite National Park

Principal Investigators: Malcolm North, Marc Meyer, Douglas Kelt

Contact Information (Phone, e-mail): mpnorth@ucdavis.edu, marcmeyer@fs.fed.us

Brief Description of Project: Using a full-factorial experimental design, this project examined the effects of prescribed burning and mechanical thinning on the food web interactions among small mammals, truffle-producing ectomycorrhizae, and dominant forest trees in Sierra Nevada mixed-conifer forests. At Teakettle, we examined truffle abundance as well as the abundance, microhabitat use, and truffle consumption by small mammals in replicate plots before and after fuel reduction treatments. In Yosemite National Park, we are examining the effect of prescribed burning on nest tree use by northern flying squirrels, the main prey of California spotted owls. This study will help determine how fuel reduction plans affect this important food web in Sierra Nevada forests.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Scientific Journal Publications include articles in Journal of Mammalogy, Canadian Journal of Forest Research, Canadian Journal of Botany, and one manuscript currently in review in Canadian Journal of Zoology. Two other manuscripts are in preparation to be submitted to scientific journals in July or August 2005.
- Scientific presentations were given at the 2004 Ecological Society of America annual meeting, 2004 Bay Area Conservation Symposium, 2002 Association of Fire Ecology annual meeting, and 2002 Sierra Nevada Science Symposium.

Public outreach presentations of this research has been given at the University of California Davis (2003-04) and the Merced Union High School District Environmental Science Academy in conjunction with the Education Office of Yosemite National Park. Additional outreach includes active participation in a USDA Forest Service movie/interactive DVD of fire research and fuels management in the Sierra Nevada. Anticipated public presentations are expected at University of California Davis, California State University Sacramento and California State University Northridge campuses in fall 2005.

Issues/Concerns; changes in research objectives, methods, or products:

One minor component of our research objectives was not addressed at Teakettle Experimental Forest due to concerns with adequate statistical replication of northern flying squirrel core nest areas in treatment plots. We are addressing this research component in Yosemite National Park, where pre-treatment data was collected on flying squirrel nest tree use in summer 2004. We will collect post-burn data pending prescribed burn treatments in Yosemite National Park in July 2005.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Optimizing landscape treatments for reducing wildfire risk and improving ecological sustainability of ponderosa pine forests with mixed severity fire regimes

JFSP Project No.: 01-1-3-22

Project Location: Colorado State University, Western Forest Fire Research Center

Principal Investigators: Philip N. Omi

Contact Information (Phone, e-mail): 970-491-5819; Philip.Omi@ColoState.edu

Brief Description of Project:

Ponderosa pine (*Pinus ponderosa* Laws.) forests in the Colorado Front Range comprise a mixed-severity fire regime with true-mountain mahogany (*Cercocarpus montanus* Raf.) as the dominant undergrowth shrub species. The objective of this project is to relate the sprouting behavior of true mountain mahogany to fire severity gradients at both landscape and individual shrub scales following the 2000 Hi Meadow and 2002 Hayman Fires.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Two poster papers have been delivered. A Master's thesis is nearing completion. Two manuscripts are in preparation for submission to a peer-reviewed journal. Additional work is planned on a biomass study that will shed insight into the role of shrubs in sustaining ponderosa pine ecosystems in mixed-severity fire regimes. An abstract of project progress will be submitted to the 3rd International Fire Congress in 2006.

Issues/Concerns; changes in research objectives, methods, or products:

Originally this project was attached to another JFSP project (same project number, M. Kauffman, P.I.), then separated. After considerable delay (approx 1.5 yr), funding was routed eventually through DOI-BLM, although the parent project proceeded without delay. Thus, feedback to the original linked project may prove limited. The no-cost extension granted for this project will enable completion of the additional work noted above.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Predicting Lightning Risk

JFSP Project No.: 01-1-6-08

Project Location: USDA Forest Service, Seattle, Washington

Principal Investigators: Miriam Rorig, Sue Ferguson, Paul Werth, Scott Goodrick

Contact Information (Phone, e-mail): 206-732-7843, mrorig@fs.fed.us

Brief Description of Project: The purpose of this project was to use atmospheric moisture and stability variables to develop a discriminant rule that assigns a probability of dry lightning over the western U.S. and over Florida. The discriminant algorithm was successfully created and tested using radiosonde data throughout the western U.S. It was applied with real-time MM5 predictions from the Northwest Regional Modeling Consortium (<http://www.atmos.washington.edu/mm5rt>). Real-time predictions of dry lightning risk for the northwestern U.S. can be found at <http://www.fs.fed.us/pnw/airfire/sf>. We also explored the relationship between dry lightning in the western U.S. and synoptic meteorological patterns, and found significant differences in the 500mb height fields between dry and wet convective days.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

This project is now complete. The major findings are:

- Dewpoint depression (850DD) and 850 – 500mb temperature difference (T850-T500) to discriminate between wet and dry convective days were found to be useful in discriminating between wet and dry convective days at other upper-air observation stations in lower elevation regions of the western U.S.
- At higher elevation sites (where the 850mb level is close to or below ground level) the 700mb dewpoint depression (700DD) and 700mb – 500mb temperature difference (T700-T500) were effective discriminators between dry and wet convective days. At lower elevation sites, however, 700DD and T700-T500 were not effective discriminators, indicating that low-level (on the order of 1000m AGL) moisture and temperature variables are important for distinguishing between dry and wet lightning.
- Using moisture and temperature variables from the MM5 vertical sigma levels (terrain-following coordinates) rather than from constant pressure levels (heights above sea level), to predict the risk of dry lightning, solved the problem of varying terrain heights.
- MM5 predictions of dewpoint depression at sigma=0.90 and the temperature difference between sigma=0.90 and sigma=0.48 were successfully used to generate predictions of dry lightning probability (<http://www.fs.fed.us/pnw/airfire/sf>). Results from a test case during the summer of 2004 showed good agreement between predicted risk of dry lightning and lightning-caused fires in the northwest US.
- Dry lightning, as we have defined it, was not a significant factor in lightning-caused fires in Florida. Most fires start when lightning ignites dry fuels, regardless of rainfall amount.

- The 500mb synoptic height patterns are substantially different on dry lightning days than on wet lightning days over the western U.S. Overall, heights are higher on dry days than on wet days. These results indicate there is potential for monthly to annual predictions of dry lightning based on phases of the El Nino – Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), and other large-scale climatic phenomena.

Deliverables include the following publications:

- Rorig and Ferguson, 2002, The 2000 fire season: Lightning-caused fires. *Journal of Applied Meteorology* 41:786-791.
- Rorig, et al., 2003, Forecasting dry lightning risk in the northwestern United States. *Proceedings of the Fifth Symposium on Fire and Forest Meteorology*, American Meteorological Society, Orlando, FL.
- Rorig, et al., 2005, Model-generated prediction of dry lightning risk in the northwestern United States. In preparation, for submission to the *Journal of Applied Meteorology*.

Output products are also available at <http://www.fs.fed.us/pnw/airfire/sf>. The methodology and software for generating these products are now available for implementation at other regional modeling centers in the western US.

We have also made several presentations at scientific conferences and meetings, and have shared results with fire weather forecasters in the Pacific Northwest Coordination Center, who are now using our output products.

Issues/Concerns; changes in research objectives, methods, or products:

None at this time.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Pre-Fire Fuel Manipulation Impacts on alien Plant Invasion of Wildland

JFSP Project No.: 01B-3-2-08

Project Location: California

Principal Investigators: Jon E. Keeley, Jan L. Beyers

Contact Information (Phone, e-mail): (559) 565-3170, jon_keeley@usgs.gov

Brief Description of Project:

This study addresses the role of fuel breaks in the invasion of alien plant species into wildland areas. We are investigating fuel breaks on lands managed by federal, state, and local jurisdictions throughout California. Our study has three objectives: 1) to inventory the current floristic composition of fuel breaks within diverse fuel types, including shrublands, woodlands and coniferous forests, and to relate patterns of alien plant distribution to fuel break parameters, including construction and maintenance methods, fire history, and land use; 2) to intensively sample belt transects perpendicular from fuel breaks into surrounding vegetation to determine the extent to which fuel breaks may act as source populations for the invasion of wildland areas; and 3) to provide resource managers with information that will allow them to plan fuel manipulations to minimize the negative impacts of nonnative invasive plants on natural landscapes.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

We evaluated the abundance of nonnative plants on fuel breaks and related fuel modification projects and in adjacent wildland areas. Our study sites were located across California in coastal scrub, chaparral, oak woodland, and coniferous forest vegetation types, and the fuel breaks we sampled represented a range of construction methods, maintenance regimes, and fire histories. Field work and analysis have been completed. Products are mostly completed but the vast amount of data collected and results will lead to several additional follow-up products.

We found that nonnative presence, cover, density, and species richness were significantly higher on fuel breaks than in surrounding wildland areas. Different fuel break construction methods, as well as several environmental covariates, were significantly associated with variation in relative nonnative abundance. Fuel breaks constructed by bulldozers had higher relative nonnative cover, lower overstory canopy cover, and lower litter cover than fuel breaks constructed by other methods. There was a significant decline in relative nonnative cover with increasing distance from the fuel break in all vegetation types. This decline was most dramatic in areas that had experienced more numerous fires during the past fifty years. Nonnative plants were more abundant in these burned areas and in areas that had been grazed. These data suggest that fuel breaks could provide establishment sites for nonnative plants, and that nonnatives may invade surrounding areas, particularly after disturbances such as fire. Fuel break construction and maintenance methods that leave some overstory canopy and minimize exposure of bare ground may be less likely to promote nonnative plants.

Management Implications:

- ☛ One of the resource costs associated with fuel break and other fuel medication practices is their potential impact on alien plant invasion.

- ☛ The problem is greatest in lower elevation shrubland and woodland formations.
- ☛ Certain methods of construction and maintenance have lesser effects than others.
- ☛ Fuel modifications have the greatest chance of enhancing non-native plant invasions when coupled with livestock grazing.
- ☛ Fuel breaks in areas with repeat fires are most likely to contribute to non-native plant invasion of untreated areas.

Application Efforts:

A web site has been created to provide managers ready access to our products and act as a clearinghouse for information on fuel modification impacts on non-native plant invasion:

<http://www.werc.usgs.gov/fire/seki/ffm/index.html>

Eighteen federal, state or local agencies were involved in this project and representatives have contacted both at the beginning and end of this project. The cooperators are listed on the web site.

Copies of all science products from this project have been (or will be) widely distributed in hardcopy form to over 150 agency contacts interested in these problems.

Technical Reports:

The following in-depth technical report of our results is currently in the editing stage and will be published as a USGS Technical Report. A draft version is attached. The final publication will be widely distributed to cooperators and a mailing list of over 150 interested parties.

Merriam, K.E., J.E. Keeley, and J.L. Beyers. The role of fuel breaks in the invasion of nonnative plants. USGS Technical Transfer Report. In review. (Draft ms attached)

Issues/Concerns; changes in research objectives, methods, or products:

Due to the volume of data collected and questions that have arisen on the issue of fuels and plant invasions we were able to produce several additional unplanned papers that synthesized current knowledge on this issue and have several additional papers planned. We also are on call to respond to managers requests for further information and presentations indefinitely.

2005 JFSP Principal Investigator Workshop - Project Progress Report

Project Title: Prescribed Fire for Fuel Reduction in Northern Mixed-Grass Prairie: Influence on Habitat and Population Dynamics of Indigenous Wildlife

JFSP Project No.: 1422R220A7-6000 01-3-2-09

Project Location: Des Lacs, Upper Souris, & J. Clark Salyer National Wildlife Refuges, ND

Principal Investigators: Robert K. Murphy, Todd A. Grant, Elizabeth M. Madden

Contact Information (Phone, e-mail): RKM 701-848-2722 x28 bob_murphy@fws.gov;

TAG todd_grant@fws.gov; EMM elizabeth_madden@fws.gov

Brief Description of Project: Prescribed fire is used increasingly to reduce accumulated fuels on National Wildlife Refuges (NWRs) and other reserves in the mixed-grass prairie region of the northern Great Plains. There is sparse documentation, however, on effects of prescribed fire on habitat and population dynamics of wildlife in the region. This multi-faceted work builds on research initiated in 1996 at J. Clark Salyer NWR in north central North Dakota, by expanding the study focus and extending replications to other NWRs. Objectives are to document effects of prescribed fire or lack of fire in mixed prairie on: productivity and nest site selection of grassland birds; small mammal makeup; vegetation composition and structure; influence of major woody fuels, firebreaks, and other landscape attributes on avian occurrence, productivity, and nest distribution. Some results are briefly summarized below.

Effects of prescribed fire on habitat, occurrence and nest survival of grassland songbirds

- 1998-2003 study on J. Clark Salyer NWR, completed with help from JFSP funding
- fire had little effect on vegetation composition such as percent cover of brush, native grasses and forbs, and invasive plants, but altered grassland vegetation structure especially during the first post-burn growing season
- bird species diversity and total abundance were reduced during the first post-burn growing season, but abundances of most species returned to pre-burn conditions during the second or third growing season after a fire
- influence of fire on nest densities varied markedly among bird species
- prescribed fire had little effect on nest survival of most grassland bird species; only nest survival of Savannah sparrow decreased, this mainly due to increased nest parasitism by brown-headed cowbirds during the first growing season following fire
- most grassland bird species appear well adapted to fires, which historically occurred about every 4-6 years in the eastern part of the northern mixed-grass prairie region

Influence of tall woody fuels on nest survival of grassland songbirds

- measured influence of tall (>3 m) shrubs and stunted trees on nest survival of clay-colored sparrow and grasshopper sparrow at Des Lacs NWR during 2001-2003
- survival of clay-colored sparrow nests declined as the number of patches of tall woody vegetation within 200 m increased, but no relationship was detected between prevalence of tall woody vegetation and Savannah sparrow nest survival
- currently completing final analyses, using a newly developed technique to investigate the impact of tall woody fuels on nest parasitism rates

Fire history, passerine abundance, and habitat on a North Dakota Drift Plain prairie

- used point counts on Des Lacs NWR to survey bird abundance on 16 management units that had been prescribe-burned one to three times each since 1992

- 3 endemic, historically common species were rare or absent regardless of “fire history” (i.e., the interaction between number of prescribed fires and time since the last fire)
- abundances of common bird species and most vegetation attributes not strongly influenced by fire history, which contrasts findings from other northern prairie areas
- vegetation structure (litter depth and plant height-density) and occurrence of an introduced grass species, smooth brome, decreased with fire history
- no relationships were detected between bird species abundances and vegetation composition or structure variables, perhaps because smooth brome was a pervasive structural influence on all management units

Recent related publications (others currently in review/in preparation):

Grant, T. A., E. Madden, and G. B. Berkey. 2004. Tree and shrub invasion in northern mixed-grass prairie: implications for breeding grassland birds. *Wildlife Society Bulletin* 32:807-818.

Murphy, R. K., and T. A. Grant. 2005. Land management history and floristics in mixed-grass prairie, North Dakota, USA. *Natural Areas Journal*: *In Press*.

Grant, T. A., and R. K. Murphy. 2005. Changes in woodland habitat on prairie refuges in North Dakota, USA. *Natural Areas Journal*: *In Press*.

Issues/Concerns; changes in research objectives, methods, or products:

Original study plan included an investigation of avian niche selection relative to fire history, but this objective was omitted because total, final funding level was less than anticipated.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Comparison of multi-resolution images and vegetation indices for fire severity mapping in the western United States

JFSP Project No.: 01-1-4-23

Project Location: California, Arizona, New Mexico, Colorado, Idaho

Principal Investigators: Jennifer L. Rechel and Dar A. Roberts

Contact Information (Phone, e-mail): 951.680.1541 (JLR) jrechel@fs.fed.us;
805.893.2276 (DAR) dar@geog.ucsb.edu

Brief Description of Project: The primary factor in estimating fire danger is fuel moisture. Fuel moisture varies seasonally and should be measured over an entire fire season using remote sensing technologies and verified using ground measurements. Recent advances in spaceborne and airborne imaging systems can potentially significantly improve the ability to assess fuel condition and moisture. Fuel condition is assessed using spectral mixture analysis (SMA) to map fractions of green vegetation (GV). Direct measures of canopy moisture can be determined using the Normalized Difference Water Index (NDWI), which we have found to be an improvement over Normalized Difference Vegetation Index (NDVI) in shrublands. Other measures used are Normalized Difference Infrared Index (NDII) and Normalized Difference Green Red Index (NDGRI). Above ground standing live biomass was collected for coniferous and deciduous forests and shrublands at seven sites in the western United States during early (low fire risk) and late (high fire risk) seasons to detect changes in fuel moisture. Ground data are used to correlate values for live fuel moisture and the image products at multiple spatial and spectral resolutions. Seasonally varying Live Fuel Moisture (LFM) data, acquired by Los Angeles County Fire Department from 1994 to 2003 were compared to AVIRIS and MODIS derived measures of fuel moisture.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Science delivery: Presentations = 12; papers = 8; workshops/demonstrations = 7; **total science delivery for CY2005= 27**; Estimated total science delivery CY2006 = 29.

Status of web page: The web page initially resides at the University of California Santa Barbara (www.icess.ucsb.edu/resac) at the Southern California Wildfire Hazard Center. Our project currently concentrates on fuel moisture analyses, results, and summaries. It will include vegetation structure in 2006. GIS maps of the study areas with imbedded digital photographs of the vegetation structure are being developed and will be added to the web page along with graphs, charts, and maps of the results. Recommendations for researchers and managers will accompany the maps. We plan to have an interactive GUI (Interface) for users (the public) to investigate and explore the project or get further information about their local public lands fuels and fuel moisture status.

Significant Research Results:

- Differences in % change in fuel moisture were most notable in oak woodlands (-23% and - 68%); in firs (+36%); ceonothus (+35%), and pinyon-juniper (+31%).

- R^2 values between fuel moisture content and MODIS products were highest on the Gila National Forest in southwest New Mexico and on the Coconino National Forest in northern Arizona
- R^2 values were lowest on Great Basin scrublands in southwest Idaho and the Sierra National Forest in central California
- Ground measurements improved the correlations and helped explain the biotic and abiotic reasons for differences in % fuel moisture values for each vegetation type
- Generally, NDVI worked best for forested vegetation types with relatively dense canopies and NDWI worked best for open areas and shrublands
- Measures of greenness (NDVI, Green vegetation) and moisture (NDWI, water thickness) were highly positively correlated with % fuel moisture in the Santa Monica Mountains, based on AVIRIS and MODIS time series data. NDWI outperformed NDVI using MODIS, while narrowband NDVI was optimal for AVIRIS
- Measures of fuel condition, derived from MODIS and AVIRIS were comparable.
- Significant interannual variation was observed in the relationship between % fuel moisture and all remote sensing measures from 2000 to 2003 in southern California shrublands.

Management Applications:

- Create comprehensive fuels maps that are consistent across agency boundaries
- Develop a series of GIS maps to track differences in % change in fuel moisture over an entire fire season for each study area
- Provide Internet based maps that communicate the results of fuels research for management, the public, and the media
- Provide recommendations to fire managers on prescribed fires based on multi-scaled % fuel moisture values for regional and local plans
- Determine the suite of image products that best represent ground based % fuel moisture values in conjunction with vegetation structural information

Issues/Concerns; changes in research objectives, methods, or products:

- Data represent a snapshot of % fuel moisture for each study area. Higher correlations between %fuel moisture and remote sensing were observed for seasonally varying fuel moisture
- There is spatial discrepancy between AVIRIS, ETM+, MODIS and the field plots
- Some field plots represent vegetation types that are limited in distribution so plot data is not spatially independent
- Initial analysis showed considerable variation between sites in the relationship between %fuel moisture and remote sensing measures. General relationships, or factors that modify these relationships should be investigated (ie, percent cover).

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Restoration of dry, montane meadows through prescribed fire, vegetation and fuels management: A program of research and adaptive management in western Oregon

JFSP Project No.: 01C-3-3-10

Project Location: Bunchgrass Meadow, Willamette National Forest, Oregon

Principal Investigators: Frederick J. Swanson, Charles B. Halpern, John H. Cissel

Contact Information (Phone, e-mail): 541.750.7355, fswanson@fs.fed.us

Brief Description of Project: We are studying the dynamics of conifer encroachment and the potential for restoration of dry montane meadows in the western Cascade Range of Oregon. In a region dominated by forest, meadows contribute greatly to landscape diversity, wildlife habitat, and other ecological functions and societal values. Throughout the Pacific Northwest, suppression of fire and changes in climate and grazing pressure have led to rapid expansion of forest into meadows. Faced by gradual loss of these habitats, managers have begun to experiment with prescribed fire as a potential restoration tool. We are engaged in research at Bunchgrass Meadow to improve our understanding of the ecology and potential for restoration of these ecosystems.

Three studies contribute to this goal:

- Retrospective analyses of patterns of conifer encroachment and associated changes in ground vegetation.
- A study of the soil seed bank and its potential to contribute to meadow restoration.
- An experimental study of vegetation response to restoration treatments (tree removal and prescribed fire).

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research - summarize information with bullet statements): Field sampling for the first study is complete,

including an intensive sample of forest structure, tree ages, and understory composition:

- Trees established during two broad intervals: 1815 to 1905 followed by massive recruitment between 1925 and 1985.
- During both periods, lodgepole pine appears to have facilitated grand fir, a pattern evident in the spatial clumping of grand fir beneath live and dead pine.
- Replacement of meadow by forest vegetation can be rapid (within 30-50 yr), particularly where grand fir has established.

In a companion study, more than 200 soil samples were collected from subplots representing open meadow, recent encroachment, and older forest. Samples were placed in germination flats and seedling emergence was monitored for 7 months.

- Most species that germinated from the seed bank were uncommon in the above-ground vegetation.
- 71% of germinants were ruderal forbs and 21% were meadow taxa (primarily *Carex pensylvanica*, the dominant meadow sedge).
- Most meadow species were absent from the seed bank, suggesting limited potential for buried seed to serve as a source of propagules if forests were removed.

These studies form the basis of two Master's theses (in progress) and will lead to 2-3 manuscripts anticipated in 2005-2006. Undergraduate students from three institutions (national and international) have also participated in independent research at these sites. These include studies of forest structure and light availability, vegetation responses to conifer encroachment, and plant diversity as influenced by gopher disturbance of meadow soils.

Pre-treatment sampling for the restoration experiment is complete and treatment implementation by the Willamette National Forest is pending. The design consists of three replicates of three treatments randomly assigned to 1-ha experimental units. Treatments are: a control, overstory removal without burning, and overstory removal with broadcast burning of residual slash. This design allows us to test (1) if overstory removal is sufficient to restore meadow composition and diversity, or if fire is necessary; and (2) the potential for restoration of meadows at varying stages of encroachment.

Issues/Concerns; changes in research objectives, methods, or products:

The restoration experiment has been delayed by one year. Felling and skidding of trees was scheduled to occur on snow (to minimize soil disturbance) in winter 2005. Unfortunately, we experienced winter drought with virtually no accumulation of snow pack. We anticipate successful implementation of treatments next winter with prescribed burning to follow in fall 2006. However, an extension of the funding period will be required to complete this work; we will submit this request in spring 2006. Agency and public interest remain high and the Rocky Mountain Elk Foundation recently awarded the McKenzie River Ranger District a small grant to assist with the prescribed burn. A variety of information exchange and outreach efforts will follow implementation of the experiment.

JFSP 2005 Principal Investigator Workshop Project Progress Report

Project Title: The Effects of Prescribed Fire Season and Fire Surrogates on Crown Adapted Knobcone Pine Forests (Project #: 03-3-3-57).

Project Location: BLM, Ukiah Field Office, Mendocino and Lake Counties, CA

Principal Investigators: James F. Dawson (BLM) and Dr. Scott Stephens (U.C. Berkeley)

Contact Information (Phone, e-mail): James Dawson, (707) 468-4079, jdawson@ca.blm.gov; Dr. Scott Stephens, (510) 642-7304, stephens@nature.berkeley.edu; Danny Fry, (510) 642-4934, dfry@nature.berkeley.edu

Description of Project: Demonstration project to contrast the efficacy of prescribed burning in different seasons, mechanical methods and fire, and mechanical methods alone in regenerating knobcone pine forests. In achieving primary objectives several secondary objectives will be addressed including the effect of season of fire and fire surrogates on (1) fire hazard reduction, (2) recovery of competing vegetation, (3) resurgence of fuels, (4) costs of different treatments, and (5) identification of the most effective treatment for regeneration of knobcone pine that is least intrusive to air quality.

Status Report: The Assistance Agreement between the BLM, Ukiah Field Office and the University of California, Berkeley, was signed on October 7, 2003. The environmental assessment completed August 24, 2004.

Research units have been identified and mapped. Forest structure (size, density, canopy, slope, aspect and age) has been evaluated for the treatment units. Line transects have been established to identify understory vegetation.

Through a BLM funded contract, all research units identified for cutting will be completed by November 2005.

The six research units identified for prescribed burning during the spring of 2005 had to be postponed until April/May 2006, as environmental conditions did not permit burning.

Six research units are planned for burning during the fall of 2005.

This project is being developed and implemented through a cooperative effort by the JFSP, BLM, U.C. Berkeley, and the California Department of Forestry and Fire Protection.

Issues/Concerns affecting the project: The prescribed burn treatments for the spring units had to be delayed by one year until 2006. It would have been preferred to have had all the different spring treatments (i.e., cut only, cut and burn and burn only units) completed in the same year. This would have eliminated uncontrolled confounding factors that could occur in different years, which may impact the study. Research analysis will now need to consider the variable of treatments occurring in different years.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Tree regeneration response to fire restoration in mixed-conifer forest

JFSP Project No.: 01-3-2-02

Project Location: Teakettle Experimental Forest, Fresno County, California

Principal Investigators: Andrew N. Gray

Contact Information (Phone, e-mail): 541-750-7252, agray01@fs.fed.us

Brief Description of Project: This study is determining the effects of alternative fire re-introduction and mechanical thinning techniques on tree and shrub regeneration and mortality, in relation to changes in soil moisture availability and light, in the mixed conifer forest of the Sierra Nevada. The Forest Service's plans for the Sierran National Forests placed a primary emphasis on fire and fuels management and re-introduction of fire as an ecosystem process. New practices are to rely on thinning and prescribed burning, but there is little data on biological responses and stand development following alternative mechanical and burning treatments. The need to reduce density of shade-tolerant fir and promote an open spacing of pine requires careful attention to tree regeneration and shrub response. Fire and mechanical treatments dramatically affect several tree regeneration parameters, including seed production, microclimate, seedbed substrates, and competing vegetation. Foresters attempting to regenerate thinned or burned stands in the Sierra have had mixed success. This study applied burning and no-burning treatments crossed with overstory thinning, understory thinning, and no thinning treatments in a replicated, factorial design on the Sierra National Forest. The study applied complementary experimental and survey approaches to better understand germination, survival, and growth of several co-occurring species in relation to the suitability of seedling microsites across treatments.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- * Two journal articles have been published on tree seedling and understory plant community relationships to within-stand structure and environment based on the pre-treatment measurements (Gray, Andrew N., Harold S. J. Zald, Ruth A. Kern, and Malcolm North. 2005. Stand conditions associated with tree regeneration in Sierran mixed-conifer forests. *Forest Science* 51(3): 198-210; and North, Malcolm, Brian Oakley, Rob Fiegenger, Andrew Gray, and Michael Barbour. 2005. Influence of light and soil moisture on Sierran mixed-conifer understory communities. *Plant Ecology* 177:13-24).
- * Several presentations have been given to scientific meetings on various aspects of our results.
- * A journal article is being prepared on the response of seedling and sapling density to the fuel-reduction and fire-restoration treatments.
- * Results will be incorporated in a video being produced to demonstrate treatment effects to managers.
- * Management implications of our findings include: 1) traditional cool-season burning treatments do not greatly reduce understory tree density, but do better than thinning alone; 2) current understory thinning treatments lead to high densities of shade-tolerant seedlings and relatively little pine; 3) shelterwood treatments promote fewer seedlings with more

representation by pine; 4) multiple management entries over time (e.g. prescribed burns) may be necessary in treated stands to preclude development of dense ladder fuels; and 5) it may be difficult to design treatments that maintain late-successional habitat and reduce understory tree density at the same time in the short term.

Issues/Concerns; changes in research objectives, methods, or products:

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire in the southern Appalachians: Fuels, stand structure and oaks

JFSP Project No.: ??? 01-33-14

Project Location: Daniel Boone National Forest, Kentucky

Principal Investigators: David Loftis, Mary Arthur

Contact Information (Phone, e-mail): D. Loftis: 828.667.5261; dloftis@fs.fed.us

M. Arthur: 859.257.2852; marthur@uky.edu

Brief Description of Project: Managers responsible for maintaining the diversity and productivity of southern Appalachian forests are increasingly turning to prescribed fire as a tool for managing oak dominated forests. While it is well documented that fire has been an important ecological force in southern Appalachian forests for a very long time, there has been little research to demonstrate that prescribed fire effectively controls fire-sensitive competitors, promotes regeneration of desirable species, or reduces fuels and the potential for unplanned fire. This project addresses these knowledge gaps through studies that examine the effects of frequent and infrequent prescribed fire on stand structure; response of seedlings, recruitment, and residual trees; and fuels. Initiated with previous USDA Forest Service, University of Kentucky and JFSP funds, this project extends our research temporally to an increasingly meaningful duration that incorporates input from managers obtained from technology transfer activities. We are characterizing stand structural changes and the resulting spatial variability in light regime created by frequent prescribed fire, infrequent prescribed fire, and no fire and quantifying the response of individual seedlings using a large seedling population study coupled with measurements of seedling recruitment, and quantifying fuel consumption and re-accumulation.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The initial effects of prescribed fire were reduced understory stem density and basal area and increased basal sprouts. Canopy cover was temporarily reduced, but returned to pre-treatment levels within one year. Sassafras seedlings had the highest survival among the species present, followed by *Erythrobalanus* oak species, *Leucobalanus* oak species, and finally, maples. A repeated measures split-plot design was used to detect differences in fuels by treatment (burned or unburned), sampling time (preburn, postburn, and 10 months postburn), and landscape position (mesic, intermediate, or xeric). Large woody fuel mass (>7.6 cm diameter) and the Oea layer of the forest floor differ by landscape position, with more Oea on xeric positions and more large woody fuels on mesic positions. Litter (Oi) and small 1-hour woody fuels were reduced postburn, but did not differ from preburn fuel loads 10-months postburn. Using regression modeling, nine variables and four interaction terms including species, DBH, and landscape position, were found to influence maximum bark scorch height on trees >2 cm DBH. Maple seedlings experienced higher mortality than all species of oak seedlings, but surviving maple seedlings achieved greater height growth following fire, compared to oaks.
- Data were collected prior to and following prescribed burning for application in a model that projects changes in oak regeneration potential. Modeling activities are ongoing.
- Two MS theses were completed (Loucks, 2004; Green, 2005). Publication of 3 to 4 papers in peer-reviewed journals is expected in the coming year.

- Our planned and completed science delivery and application efforts include a website that is now active (<http://www.fs.fed.us/r8/boone/fire/fsa/team.shtml>); a regional fire research conference, scheduled for September 30, 2005 at Morehead State University; and annual meetings with Daniel Boone National Forest Management Team and other National Forest personnel for information exchange.

Issues/Concerns; changes in research objectives, methods, or products:

There have been no substantive changes in research objectives, methods or products. We have a new MS student on the project, funded by the University of Kentucky with separate funds, who will contribute to the accomplishment of research goals and is expected to complete a MS thesis within the timeline of this project.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of prescribed fire on the invasion of northern mixed-grass prairie by non-native plant species

JFSP Project No.: 01B-3-3-03

Project Location: Lostwood NWR, ND and Des Lacs NWR, ND

Principal Investigators: Drs. Jennifer Rubin, T. Weaver, and C. Rubin; Fred Giese

Contact Information (Phone, e-mail): Jennifer.Rubin@roch.edu, 507-285-7149

Brief Description of Project:

We seek to measure the effects of fire and grazing on weeds of the northern mixed grass prairie.

To accomplish this we are interpreting measurements from two management experiments, one at Lostwood National Wildlife Refuge (NWR) and one at Des Lacs NWR.

At Lostwood we found a nearly balanced 2x7 treatment experiment with seven burning treatments (0-6 burns), two grazing treatments (+/-), and four habitat types (bottoms, n-slopes, s-slopes, and hilltops). The responses of nine weeds including *Bromus inermis*, *Poa pratensis*, and *Symphoricarpos occidentalis* have been recorded at five sites in each unit x environmental type (500 samples). The invasiveness of each plant was indexed with frequency measures and its tendency to dominate was indexed with cover measures. The data have been analyzed by multiple regression of 'presence' against habitat, number of burns, the Habitat by number of burn interaction, season of burn, years since burning, grazing (+/-), and number of grazing treatments.

The study has been replicated at Des Lacs NWR. This experiment has eight burning treatments (0-7 burns), two grazing treatments (+/-), 4 habitat types (bottoms, n- or e-slopes, s- or w-slopes, and hilltops) and four reps. The same weeds were studied and with the same measures.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):**Accomplishments:**

Report on management effects of fire and grazing treatment at Lostwood NWR will be available this fall. Invasion rates (frequency) is significantly affected by HABITAT in eight of nine weeds and tendency to dominate (cover) is significantly affected by habitat in only one weed. Some aspect of FIRE affected frequency in seven of nine weeds and affected dominance in six of nine weeds. Some aspect of GRAZING affected frequency in five of nine weeds and cover in three of nine weeds. Despite highly significant results, the factors considered accounted for less than 20% of the variation observed (i.e., low r^2). The LOW R^2 may be due in part to inadequate control in the management experiment. They are likely due, in large part, to their highly significant, but relatively weak impacts. Thus, while the burning and grazing treatments are useful, and may be refined to improve them, COMPLIMENTARY METHODS OF WEED CONTROL must be proposed, tested, and applied.

Report on management effects of fire and grazing treatment at Des Lacs NWR will be available this fall. Data in, analysis nearly complete. Parallel results expected.

In April 2005, a half-day workshop on weed management in the northern mixed grass prairie was presented in conjunction with the US Fish and Wildlife Service/US Forest Service Invasive Species Workshop organized by Will Meeks (Refuge Manager, Lostwood NWR). 200 were in attendance. Talks in this half-day symposium considered invasability (1), indicators of invasion (3), demonstration of invasion (3), effects of invasion (1), and restoration (1).

Information related to this Joint Fire Science Project will be available on the Des Lacs NWR website this fall.

We expect to submit at least two papers for publication in the coming year.

Issues/Concerns; changes in research objectives, methods, or products:

We expect to complete our project on time.

Our data set may lend itself to post-project analysis.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire Use Over a Southwestern Elevational Gradient: Effects of 2003 Fires

JFSP Project No.: 04-1-2-04

Project Location: Grand Canyon National Park, Arizona

Principal Investigators: Peter Z. Fulé, Daniel Laughlin (Northern Arizona University), Cole Crocker-Bedford (Grand Canyon National Park)

Contact Information (Phone, e-mail): 928-523-7182, pete.fule@nau.edu

Brief Description of Project: In 2003, a series of 4 lightning-ignited wildland fires were managed to burn over 19,000 acres on the North Rim. These fires burned over approximately 82 permanent plots that had been established within the previous 2-6 years. The burned plots range in elevation from 7,500 to over 8,600 feet, representing all the high-elevation forest types in southwestern forests (ponderosa pine, mixed conifer, aspen, and spruce-fir). A wealth of data already exists about the plot network, including fire regimes, reconstructions of past forest structure, and modeling of changes in canopy fuels and fire hazard over time. We have collected post-fire data and are analyzing the relationships between pre-fire conditions, observed fire behavior, and fire effects. Rapid response is essential because we have the unique opportunity for post-fire sampling from fires occurring in a single year over plots arrayed across such a large environmental gradient.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- In 2004, we remeasured all 82 plots burned by the wildland fires. Plots were generally easy to relocate. We replaced tree tags that were destroyed by heat. We added measurement of an additional 20 unburned plots in order to more accurately assess fire-caused mortality in light of "background" mortality on the unburned plots.
- Data were collected both electronically and on paper. Data collected on paper have all been entered in an Access database.
- Quality control queries have been completed and all the data collected in 2004 has been corrected.
- On April 24, 2005, we received permission from the JFSP board to defer our final report on the effects of the wildland fire use fires on forest structure. The reason for this request was to carry out another measurement of tree condition (living/dead) in 2005 in order to more accurately assess fire effects, since mortality often takes more than one growing season to become evident.
- In June and July, 2005, we completed the second-year remeasurement of the permanent plots.
- Data entry and error checking is in progress.
- Analysis and reporting will take place this fall. The project is on schedule and on budget.
- As noted below, we have expanded the scope of the project with external funds.

Issues/Concerns; changes in research objectives, methods, or products:

We took advantage of an opportunity to build on the scope of this project with external funds. We have added measurement of the understory plant community on the permanent plots and added complete measurements (overstory and understory) on additional plots that were not burned in the wildland use fires. These additional measurements add two important components: (1) by including understory plants, the study will provide a better assessment of the overall ecological effects of the fires. This is especially relevant to management because the park is currently engaged in the environmental analysis of fire management options. (2) The measurements on unburned plots provide an estimate of tree mortality and plant community change in the absence of fire, providing a scale of comparison against the burned plots.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: A Web-based Information System for Estimating Fuel Characteristics, Fire Hazard, and Treatment Effectiveness

JFSP Project No.: 04-4-1-21

Project Location: Missoula, MT

Principal Investigators: Carl Fiedler (UM); Roger Ottmar (Federal Cooperator)

Contact Information (Phone, e-mail): carl.fiedler@cfc.umontana.edu; (406)243-5602; rottmar@fs.fed.us; (206)732-7826

Brief Description of Project

This project has three objectives: 1) Classify ponderosa pine, Douglas-fir, and dry mixed-conifer forests types in Montana and New Mexico into appropriate fuel characteristic classes (FCC's), and display the results by forest type, density, and structural classes, 2) Develop web-based applications by which users can evaluate the effectiveness of alternative hazard reduction treatments and estimate the costs of implementing treatments and neutralizing activity fuels, and 3) Develop and link descriptions, computer visualizations, and/or photos that will allow users without stand-level inventories to estimate fuel characteristics, fire hazard, and treatment effectiveness and costs for their conditions of interest.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Planned Efforts

- Calculate appropriate Fuel Characteristic Classes (FCC's) using FIA data for fire-adapted forest types in Montana and New Mexico.
- Cross-classify acreage by FCC in each state into previously-developed forest type, density, and structural classes.
- Develop software to seamlessly convert stand-level inventories into stand tables as inputs for treatment prescription ("computer logging") algorithms, harvest cost/product revenue models, and fire hazard calculators.
- Develop stand descriptions, computer visualizations, and/or photos to allow users without inventories to estimate fire hazard and treatment effectiveness and costs for their situations.

Deliverables

- Summary of acres by FCC for fire adapted forest types in Montana and New Mexico.
- Web-interface (built on web services) that allows users with stand-level inventories to evaluate "what if" hazard reduction treatment scenarios as to their effectiveness and cost.
- Web-based system that allows users without stand-level inventories to evaluate "what if" hazard reduction treatment scenarios based on descriptions, visualizations, and photos.

Management Implications

- The web-based system developed in this project will allow users to "game" different treatment scenarios, and then weigh trade-offs between estimated effectiveness and cost of attaining a given level of hazard reduction – *before* implementing such treatments. This is particularly important given that many of today's managers have little practical experience in developing such prescriptions.

- The seamless connection of various computational algorithms and software packages is a complicated process; once completed, it will provide a generic model for linking other types of algorithms and software for other management applications.

Issues/Concerns; changes in research objectives, methods, or products:

Issue 1: Our project did not start on July 1, 2004, as originally scheduled, because funding did not arrive until mid-March, 2005.

Issue 2: We have just begun working with the latest (August 4, 2005) release of the FCC Calculator.

Issue 3: We are investigating the integration into our web-based system of other approaches (or calculators) for predicting fire hazard/crown fire potential that may be more sensitive to treatment-induced changes in stand attributes.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Development and demonstration of smoke plume, fire emissions, and pre- and post-prescribed fire fuel models on North Carolina Coastal Plain forest ecosystems

JFSP Project No.: 04-2-1-80

Project Location: Alligator River National Wildlife Refuge and Air Force Dare County Bombing Range, Dare County, North Carolina

Principal Investigators: Robert Mickler, Sue Ferguson, Gary Achtemeier, Chris Geron

Contact Information (Phone, e-mail): phone: 919-406-2104; email: robert.mickler@alionscience.com

Brief Description of Project: The proposed research will provide fire management tools to land managers that integrate fuel loading, fire emissions, and smoke plume measurements and modeling. The objectives are to (1) Inventory, map, and model live and down woody debris/fuels biomass utilizing USDA Forest Service Forest Inventory and Analysis P2 and P3 field plot protocols, develop fuel loading formulas for fire behavior models in the Alligator River National Wildlife Refuge and the Air Force Dare County Bombing Range in the North Carolina Coastal Plain, and incorporate data from Coastal Plain forest types into the fuel characteristic classification (FCC) system and the FARSITE fire behavior model; (2) Validate the USDA Forest Service PB-Coastal Plain smoke model, the BlueSky smoke prediction system, and the BlueSky Rapid Access Information System (BlueSkyRAINS) for the near-coastal land-water interface, including differences in vegetative land use; (3) Characterize photochemically active and radiatively important trace gases as well as PM emissions from prescribed burns in Coastal Plain forest types and histosol soils, and (4) Deliver personal computer and web-based decision support tools for estimating inputs of live biomass and down woody debris/fuels into a fire behavior model, real-time smoke plume models, and an emissions model for prescribed burns for use by federal and state land managers in North Carolina specifically, and other users throughout the Coastal Plain of the southeastern US.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Year One Deliverables:

- Wildland fuel mapping: Aerial color IR photography acquired for Dare County, NC; NVCS vegetation delineation completed for four prescribed burn sites; USFS FIA P2 and P3 plots established in each NVCS alliance level vegetation type and pre-burn fuel loading calculated; Prescribed fire prescriptions written for four sites.
- BlueSky smoke prediction system daily runs conducted for Dare County prescribed fire site using site fuel loading and SHRMC MM5 4 km grid output; DaySmoke plume dispersion model calibrated with Brigg's equations and run on USFWS Cedar Island Refuge prescribed burn; FCAMMS GIS display for BlueSky is 75% complete; PB-Coastal Plain validation under development.
- USDA Forest Service, US EPA, US FWS, and research staff and equipment were deployed for two prescribed burns in Spring 2005. First burn declared a no go due to weather conditions and second burn shut down following ignition due to changing weather conditions.
- Project poster presented at XXII IUFRO World Congress; Project website under development.

Issues/Concerns; changes in research objectives, methods, or products:

Issues:

- AirFire team equipment loss by FedEx during transport to NC. USDA FS provided emergency funding to assist in equipment replacement.
- Expenditures for travel by AirFire team in Spring 2005 for a no go and a shut down prescribed burn will require careful use of existing travel funds.

Concerns:

- Due to unusually wet prescribed burn season weather in Spring 2005 in southeastern US the two proposed prescribed burns were not accomplished. Plan to conduct four prescribed burns in Fall 2005.
- USDA Forest Service computer hardware will need replacement for MM5, PB-Coastal Plain, and BlueSky model runs.

Changes in research objectives:

- Added development and validation of new Coastal Plain day time smoke dispersion model entitled "DaySmoke".

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Photo Series for Major Natural Fuel Types of the United States—Phase II
JFSP Project No.: 98-1-1-05

Project Location: Pacific Wildland Fire Sciences Laboratory, Seattle, Washington

Principal Investigators: Roger D. Ottmar

Contact Information (Phone, e-mail): (206) 732-7826; rottmar@fs.fed.us

Brief Description of Project: The natural fuels stereo photo series is a collection of geo-referenced data and photographs that display a range of natural conditions, fuel loadings, and other fuelbed characteristics in a wide variety of forest-, woodland-, shrub-, and grass-dominated ecosystem types. The photo series are useful tools for quickly and inexpensively evaluating vegetation and fuel conditions in the field. The objectives of this project were to: (1) complete an assessment of the literature and the needs of land managers to define a maximum of 10 fuelbed types and their associated fuel elements for further development of the Natural Fuels Photo Series; (2) locate, photograph, and inventory a maximum of 20 sites within a fuelbed type that cover a range of fuel and vegetation conditions and (3) produce a printer-ready manuscript, and assist with the printing process.

Older photo series were reviewed and a needs assessment was conducted among managers and scientists to determine the fuelbed types and elements for inclusion in this project. A total of 9 fuelbed types were selected resulting in four photo series volumes: (1) Volume IIa: Hardwoods with spruce types in Alaska (Ottmar and Vihnanek 2002); (2) Volume Va: Jack pine in the Lake States (Ottmar et al. 2002); (3) Grassland, shrubland, woodland, and forest types in Hawaii (Wright et al. 2002); and (4) Volume VII: Oregon white oak, California deciduous oak, and mixed conifer with shrubs in the western United States (Ottmar et al. 2004). Volumes IIa, Va, and VII can be purchased from the National Interagency Fire Center, publication Management System for a small charge. The Hawaii photo series (PNW-GTR-545) is available free of charge from the Pacific Northwest Research Station. Data collected for this photo series effort allowed the Fuel Characteristic Classification System (JFSP 98-1-1-06) to be more robust and include more fuelbed types in historically data-poor fuel types across the United States.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Science Deliverables:

1. Four printed photo series volumes containing nine fuelbed types with 100 sites.
2. Four JFSP progress reports
3. Website link to the photo series project at:
<http://www.fs.fed.us/pnw/fera/photoseries/>
4. RX-410 Photo Series training package
5. Eleven poster presentations and published abstracts.
6. Photo series photo scans and fuelbed data to the Missoula Fire Lab Fire Behavior project for building new fire behavior fuel models.
7. Final report

Applications:

1. Developed RX 410 training package on how to use the photo series.
2. Thirty-five photo series presentation and exercises at RX 410 (Smoke Management), RX 300, (Burn Boss), and RX 310 (Fire Effects) national and regional training sessions.
3. Provided photo series photo scans and fuelbed data to the Missoula Fire Lab Fire Behavior project for building new fire behavior fuel models.

Management:

The photo series are useful tools for quickly and inexpensively evaluating vegetation and fuel conditions in the field. Thousands of managers use the photo series to reduce the time and effort to estimate fuel loadings for fire and fuels planning.

Issues/Concerns; changes in research objectives, methods, or products: None. The project was completed and final report and 4 photo series delivered in June 2005.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Application of a Fuel Characterization System for Major Fuel Types of the United States and Alaska

JFSP Project No.: 98-1-1-06

Project Location: Pacific Wildland Fire Sciences Laboratory, Seattle, Washington

Principal Investigators: Roger D. Ottmar

Contact Information (Phone, e-mail): (206) 732-7826; rottmar@fs.fed.us

Brief Description of Project: The Fire and Environmental Research Applications team has completed the Fuel Characteristic Classification System (FCCS), and the software can be downloaded from the FCCS website: <http://www.fs.fed.us/pnw/fera/fccs/>. The FCCS is designed as a interactive program to build, store, catalog, and calculate characteristics and fire potentials for both simple and complex fuelbeds across the United States. The FCCS offers fire and fuel managers, air quality regulators, researchers, and carbon modelers a nationally-consistent, and durable system of fuelbed characterization and classification that captures the structural complexity, geographical diversity, and disturbance history (including elements of human (e.g. logging slash) and natural (e.g. windthrow) change) of fuels throughout the United States. The user can access a fuelbed from the national fuelbed database within the FCCS or modify existing descriptions with enhanced or more detailed information to create fuelbeds to represent a particular type or scale of interest. The FCCS stores and reports assigned and calculated characteristics for each component that is part of the fuelbed including the trees, shrubs, grasses, woody fuels, litter, and duff for national and user-defined fuelbeds. The FCCS also calculates surface fire behavior, crown fire, and available fuel potentials for each fuelbed and assigns each fuelbed a fire behavior fuel model.

The FCCS facilitates mapping of fuelbed characteristics and inventory of emissions from wildland fires by providing fuelbeds and the associated fuelbed characteristics to run fuel consumption and emission production models such as Consume 3.0, FOFEM, and the Fire Emissions Production Simulator (FEPS); and provides starting point information for FVS-FFE.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Science Deliverables:

1. Fuel Characteristic Classification System (with Help section)
2. FCCS national fuelbeds delivered to FOFEM, Consume 3.0, and LANDFIRE
3. 1 peer reviewed paper; 4 proceedings papers; 5 progress reports; 17 poster presentations
4. FCCS website
5. Final report

Applications:

1. Initiated an FCCS implementation and mapping project on the Okanogan, Wenatchee, and Deschutes National Forests; and on the U.S. Fish and Wildlife Service refuges in Alaska.
2. Mapped the FCCS national fuelbeds at 1-kilometer across the 48

contiguous states

3. Presented 4 seminars and demonstrations of FCCS for LANDFIRE, Interagency Fuels Committee, and Missoula Fire Lab.

Management: FCCS is designed as an interactive program to build, store, catalog and calculate characteristics and fire potentials for both simple and complex fuelbeds across the United States. The FCCS will allow users to develop maps of FCCS fuelbed characteristics and surface fire behavior, crown fire and fire effects potential at stand, watershed, and landscape scales to identify and test strategies for prioritizing and implementing vegetation treatments at multiple spatial and temporal scales.

Issues/Concerns; changes in research objectives, methods, or products: None. The project was completed and final report delivered on August 2, 2005.

Project Title: Characterizing Historic and Contemporary Fire Regimes in the Lake States

Project Location: Michigan, Minnesota, Wisconsin

Principal Investigators: David Cleland, Thomas Crow, Sari Saunders, Ann Maclean

Contact Information (Phone, e-mail): 715-365-1103, dcleland@fs.fed.us

Description of Project: This project has: (1) Synthesized available information on historic fire regimes; (2) Mapped landscape ecosystems of varying susceptibility to disturbance across sixty million acres of forestlands in Michigan, Minnesota, and Wisconsin; and (3) Documented how fire regimes have changed since European settlement.

Status Report: The emphasis in the past year has been technology transfer to Federal and State agencies, applications of results, and publications.

Technology transferred to National Forest System and State Departments of Natural Resources

- The team has delivered maps and database products of attributes across 60 million acres to National Forests and State Departments of Natural Resources.
- The products include maps of historical fire and wind boundaries, fire risk, historical fire regimes, landscape ecosystems (LTAs) and biophysical units (ELTs) of varying susceptibility to wildfire, and point data entered in GIS on historical vegetation and modern fires.
- Maps have been adopted by National Forests and Wisconsin DNR for identifying communities at risk.
- Products are being distributed to Michigan and Minnesota DNR for assessing fire risk.

Results are being applied in research, resource assessment, planning, and management.

- Data assembled for the project used to produce 17 reference descriptions for LANDFIRE applications including the National FRCC rapid assessment and the Lake States interagency FRCC workshop
- Condition Class mapping for implementing the Healthy Forest Restoration Act is being completed for all National Forests in the Lake States.
- Data on historical and modern vegetation and fire occurrence, NRCS soil surveys, and ancillary data provided to national LANDFIRE Rapid Assessment team.
- Data on historical forests and fire provided to Michigan Technological University, Michigan State University, University of Wisconsin-Madison, Iowa State University, University of Toledo, and Southern Illinois University for research applications.

Additional analyses have been completed

- Classification and regression tree analysis of social and ecological factors associated with modern fire occurrence has been completed for Michigan, Minnesota, and Wisconsin; manuscripts are in preparation for peer review and publication.
- Comparisons of historical to modern forest fire rotations and vegetation (FIA versus General Land Office point data) have been completed across the study area.

Six invited presentations have been made in the past year:

- Keynote at TNC Fire Learning Network;
- Keynote at Lake States FRCC Workshop hosted by National FRCC Team
- Keynote at Michigan Prescribed Burning Council Workshop
- Keynote at Wisconsin Prescribed Burning Council Workshop
- Presentation at TNC National Fire Initiative training session
- Presentation to Great Lake Forest Fire Compact

Five manuscripts have been published the past year

- Characterizing historical and modern fire regimes in Michigan (USA): A landscape ecosystem approach. *Landscape Ecology* 19: 311–325, 2004. David T. Cleland, Thomas R. Crow, Sari C. Saunders, Donald I. Dickmann, Ann L. Maclean, James K. Jordan, Richard L. Watson, Alyssa M. Sloan and Kimberley D. Broszofske.
- Human influence on the abundance and connectivity of high-risk fuels in mixed forests of northern Wisconsin, USA. *Landscape Ecology* 19: 235–253, 2004. Brian R. Sturtevant, Patrick A. Zollner, Eric J. Gustafson and David T. Cleland
- Assessing Fire Risk in the Wildland-Urban Interface. *Journal of Forestry*. 2004. October/November. pp. 41-48. Robert G. Haight, David T. Cleland, Roger B. Hammer, Volker C. Radeloff, and T. Scott Rupp.
- Severe Wind and Fire Regimes in Northern Forests: Historical Variability at the Regional Scale. *Ecology*, 86(2), 2005, pp. 431–445. Lisa A. Schulte and David J. Mladenoff.
- Available Fuel Dynamics in Nine Contrasting Forest Ecosystems in North America. *Environmental Management* Vol. 33, Supplement 1, 2004, pp. 87–107. Soung-Ryoul Rhy, Jiquan Chen, Thomas R. Crow, Sari. C. Saunders.

Manuscripts in preparation

- Relative influence of human versus ecosystem variables on modern fire disturbance in northern Wisconsin. Submitted to the *International Journal of Wildland Fire*. Brian R. Sturtevant and David T. Cleland.
- Interpreting the ecological, social and climatic drivers of modern fire regimes across the northern Great Lakes Region: USA. Sari. C. Saunders, Brain R. Sturtevant, Kim D. Broszofske, and David T. Cleland. Journal to be determined.
- Comparison of Historical and Modern Fire Regimes in Province 212: Michigan, Minnesota, and Wisconsin. Cleland, D.T., K.D. Broszofske, S.C. Saunders, and A.M. Maclean. Target Journal: *Forest Ecology and Management*.
- Landscape Ecosystems of Varying Susceptibility to Fire Disturbance in the Lake States. D.T. Cleland, K.D. Broszofske, S.C. Saunders, A.M. Maclean. Journal to be determined.

Issues/Concerns affecting the project: Data development for historical forest conditions and disturbance required substantial financial and time investments; this data is fully developed and analyzed now. We discovered the enormous value of SSURGO certified NRCS order 2 soil surveys while mapping landscape ecosystems of varying susceptibility to fire, and have assembled and analyzed all available information. The project has taken longer than anticipated. However the quality of our products has been improved as a consequence at no cost to the Joint Fire Science Program.

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: A Risk-based Comparison of Potential Fuel Treatment Trade-off Models

JFSP Project No.: 98-1-8-06

Project Location: Riverside, CA

Principal Investigators: Weise DR, Kimberlin RA, Arbaugh MA, Jones GJ, Chew J, Merzenich J, Wiitala M, van Wagtendonk J

Contact Information (Phone, e-mail): 9516801543, dweise@fs.fed.us

Brief Description of Project:

This project compared and contrasted the ability of 3 simulation modeling systems (VDDT, FETM, SIMPPLLE/MAGIS) to predict the effects of fuel treatments on wildfire occurrence, vegetation distribution, and smoke production in 8 major fuel types in the U.S. Sensitivity of the models to changes in the accuracy of historical fire frequency and ability of the models to simulate actual changes in vegetation distribution with a known disturbance history were evaluated. Data requirements and ability to use the models was assessed.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

The project is completed and the final report is being prepared. Landscapes ranging from 100,000 to over 500,000 ha were used to evaluate the models.

- Working copies of the models were produced for chaparral (Angeles NF), Sierra Nevada forests (Yosemite), northern Rocky Mountains (Bitterroot NF), sagebrush-pinyon juniper (Utah BLM, Fishlake NF), southern Rocky Mountains (Gila NF), mixed hardwood-jack pine (Huron-Manistee NF), longleaf pine (Blackwater SF-Conecuh NF-Eglin AFB), and spruce bug-kill (Kenai Borough AK).
- Several proceedings papers and presentations have been made. We anticipate 2-3 refereed articles resulting from the final report.
- Modeling results have been shared with a majority of the locations. In some instances, scenarios from current management documents or future planning documents were included in the fuel treatment scenarios simulated at some of the locations.
- Data sufficient to run the models at the locations were sometimes incomplete or nonexistent requiring synthesis from the literature (for successional information). Other data had to be developed by contracted research (Alaska). The management implication for this is that a significant investment in time and effort will be necessary to set up one of the models for use. This project established models for 8 major fuel types in the U.S. and can be modified for similar locations.
- At all 8 locations, the model developers performed a majority of the work necessary to setup and run the models. Because of time and work constraints on the local managers, we were unable to evaluate the ease of use of the models. In order to use the models, specialized skills are necessary and the appropriate location for this type of analysis is perhaps located in a regional or state planning office where these skills can be developed and honed.
- The historical retrospective indicated that the models were able to reasonably reproduce the vegetation changes that occurred in Yosemite NP from the mid-1930's

until the mid-1990's. However, detailed comparison was not possible due to differences in vegetation classification systems in 1930 and 1990, limited structural data available in 1930, and delay in the vegetation classification and inventory in 2000. Changes in the species composition were subtle given the short time period (60 years) and it was not possible to compare predicted structural changes measured data.

- Sensitivity analysis of the effect of fire frequency on model predictions on the Angeles NF showed the close linkage between disturbance and successional pathways. For plant succession where fire plays a significant or frequent role, model predictions were strongly affected by accuracy of fire frequency. For successional pathways with low probability of fire (low fire frequency), model predictions were relatively insensitive to accuracy of fire frequency.
- Each model has unique characteristics and a niche into which it fits. The type of question that must be analyzed determines the model most appropriately used.
- Details and an executive summary will be provided in the final report which will be delivered at the PI meeting in November.

Issues/Concerns; changes in research objectives, methods, or products:

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Modification and Validation of Fuel Consumption Models for Shrub and Forested Lands in the Southwest, Pacific Northwest, Rockies, Midwest, Southeast, and Alaska

JFSP Project No.: 98-1-9-06

Project Location: Pacific Wildland Fire Sciences Laboratory, Seattle, Washington

Principal Investigators: Roger D. Ottmar, David V. Sandberg, and Robert E. Vihnanek

Contact Information (Phone, e-mail): Phone: (206) 732-7826; rottmar@fs.fed.us

Brief Description of Project: The purpose of this project is to modify and improve existing fuel consumption models to better predict the consumption of fuels during wildland fires in fuel types where there is a limited knowledge base and where there expected to be an increase in prescribed burning. The major focus of the project is directed primarily at nonforested fuel types. The effort will also lead to better predictions of fuel consumption during the smoldering stage in fuel types where residual smoke is a consistent problem. Empirical models derived from these new data will be implemented into Consume 3.0; and used to validate existing fuel consumption models including Consume 1.0 (Ottmar and others 1993), Consume 2.1 (Ottmar and others, 2001), Burnout (Albini and Reinhardt 1997), and FOFEM 5.0 (Reinhardt and others 2002). This study is composed of 6 major tasks that will be completed in 2005. The tasks include: (1) a needs assessment; (2) study plan development; (3) field data collection and analysis; (4) new and modified model implementation into the user software product Consume 3.0; (5) user manual and training package completion; and (6) scientific documentation.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

The Fire and Environmental Research Applications Team has completed the data collection, data analysis, model development, and software application (Consume 3.0) that will allow users to predict fuel consumption and smoke emissions from many different fuelbeds during wildland fires throughout the United States. Consume 3.0 is the principal science delivery product for the project and is expected in October, 2005.

- Science Deliverables:
1. Seventy-one sites were inventoried and burned in black spruce and hardwoods (Alaska), chaparral (California), ponderosa pine/mixed conifer (Oregon), and pine/hardwood mix (South Carolina, Tennessee, and Florida). Thirty-five sites were inventoried and burned in sage on BLM, National Park Service, and U.S. Fish and Wildlife Service lands in eastern Oregon, Nevada, Wyoming, Utah, and California.
 2. Consumption models were built for each fuel category for black and white spruce/hardwoods, longleaf and loblolly pine, ponderosa pine, grasses, and sage fuelbed types.
 3. Consume 3.0 is being finalized for release in October 2005. It will include a direct link to the Fuel Characteristic Classification System, and new or modified fuel consumption models that will better represent the pine, spruce, hardwood, shrub, and grass types during the flaming, smoldering and residual combustion phases throughout the United States.
 4. One proceedings paper and 7 poster presentations have been completed.

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| Applications: | 1. 35 fuel consumption and Consume 3.0 demonstrations and exercises were presented at several national and regional training sessions including RX 410 (Smoke Management), RX 300, (Burn Boss), and RX 310 (Fire Effects). |
| Management: | 1. Consume 3.0 will enable managers to easily and quickly evaluate and predict fuel consumption and total emissions produced by fuelbed category for the flaming, smoldering, and residual combustion phases. This will improve the fuels and fire planning for fire effects and smoke management. Thousands of managers use Consume 2.1 and will find Consume 3.0 much more versatile, improved, and applicable to more areas of the United States. |

Issues/Concerns; changes in research objectives, methods, or products: None. The project was delayed but Consume 3.0, Help documentation, and final report will be completed by October 2005.
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2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Changing Fire Regimes, Increased Fuel Loads and Invasive Species: Effects on Sagebrush Steppe and Pinyon-Juniper Ecosystems

JFSP Project No.: 00-1-1-03

Project Location: Oregon, Idaho, Utah, Nevada

Principal Investigators: J. Chambers, D. McArthur, R. Miller, R. Tausch, R. Blank, S. Meyer, B. Roundy, S. Monsen, N. Shaw, S. Bunting, S. Walker, A. Whittaker, M. Pellant

Contact Information (Phone, e-mail): Jeanne C. Chambers, jchambers@fs.fed.us; 775-784-5329

Brief Description of Project: Pinyon-juniper woodlands and Wyoming big sagebrush ecosystems have undergone major changes in vegetation structure and composition since settlement by European Americans. These changes are resulting in dramatic shifts in fire frequency, size and severity. Effective management of these systems has been hindered by lack of information on: (1) presettlement fire regimes and the spatial and temporal changes that have occurred in Intermountain Region woodlands and sagebrush steppe ecosystems; (2) changing fuel loads and the consequences for the ecosystem types and conditions that currently exist on the landscape; and (3) the environmental and ecological factors that influence community susceptibility to invasive species. This integrated, collaborative project has attempted to address each of these information needs. It evaluates the spatial and temporal dynamics of the shrublands and woodlands prior to settlement by using a combination of plant community, stand structure, and dendrochronology data. It examines the changes that have occurred in fuel loads since settlement and provides a comparison of the fuel loading characteristics for ecosystems that are functional, at risk, or that have been converted to annual grasses or secondary weeds. Finally, it evaluates key factors influencing community susceptibility to invasion by cheatgrass (*Bromus tectorum*) and the secondary weeds, squarrose knapweed (*Centaurea virgata* var. *squarrosa*) and Rush skeleton weed (*Chondrilla juncea*). The project is providing regional and local information on characteristics of woodlands and shrublands at greatest risk of catastrophic fire, most susceptible to cheatgrass and weed invasion, as well as most suitable for prescribed fire. It also is providing information on the effects of resource availability, community condition, and fire on community susceptibility to cheatgrass and secondary weed invasion.

Status Report:

- The timing and rate of tree expansion have been determined for selected sites across the Region. Expansion of pinyon and juniper trees into sagebrush communities began in 1850 for western juniper in Oregon, in 1890 for single-needle pinyon in Nevada, and in 1910 for Utah juniper in Utah. On sites occupied by trees, there has been a linear increase in tree density. For example, in Nevada, this has amounted to about 2.0 trees/ac/year over the last 100 years. Future projections indicate that about 20% of the area currently occupied by trees has high tree density, and about 70% of the area will have high tree density in about 50 years. **Although rates of increase vary, this is a region-wide phenomenon.** Site specific differences exist, and in Oregon high elevation/low exposure sites are fully occupied by western juniper within 80 - 120 years, while low elevation/high exposure sites are occupied in about 120 - 170 years. This information is being used to guide fuels management programs. An MS thesis, peer-reviewed publication, and GTR are resulting from this work.
- The change in fuel-loads resulting from tree expansion are being quantified for the same sites. **As a result of tree expansion, fuel loads and the risk of catastrophic fire are increasing across the Region.** The increase in fuel loads on sites with single-needle pinyon and Utah juniper in Utah is representative of changes occurring across the Region. Fine fuel loads of trees increase from 0.5 tons/acre on sites with low tree abundance (~ 12% cover) to 15 tons/acre on sites with high tree abundance (~74% cover). In the same area, total fuels increase from 1.2 tons/acre on sites with low cover to 38 tons/acre on sites with high cover. In the initial stages of tree expansion, the associated sagebrush species influence fuel loads and fire behavior. Modeling fire behavior with BEHAVE indicates that fire size initially increases as tree cover

increases across the landscape. When the abundance of understory vegetation and, thus, fuels begin to decrease as a result of competition from trees, fire size then decreases for a time. This work is resulting in an MS thesis, 2 peer-reviewed publications, and a GTR.

- The effects of fire and herbaceous understory depletion on the susceptibility of sagebrush ecosystems to invasion by cheatgrass (*Bromus tectorum*) has been examined in two watersheds in Nevada and Utah. High elevation sites routinely have colder temperatures and lower emergence and survival indicating a possible upper limit to the distribution of cheatgrass. Burned plots have higher levels of available resources and, thus, growth and reproduction of cheatgrass. Also, burned plots with herbaceous understories that are intact and in relatively high ecological condition have lower growth and reproduction of cheatgrass than those with depleted understories. ***Disturbances that result in removal of perennial native vegetation can increase both resource availability and cheatgrass growth and reproduction, and these effects are significantly greater when coupled with fire.*** One MS thesis, 3 peer-reviewed publications, and a GTR will result from this work.
- Rush skeletonweed (*Chondrilla juncea* L.), an invasive Eurasian apomictic perennial weed, has spread southward throughout Idaho and recently invaded sagebrush steppe communities of the Lower Snake River Plain. ***A survey of the Lower Snake River Plain to identify the extent and characteristics of invaded areas indicates that infestations of rush skeletonweed occur in abandoned dryland cropping areas, road right-of-ways, and in degraded crested wheatgrass seedings, and basin and Wyoming big sagebrush (*Artemisia tridentata* Nutt. ssp. *tridentata* and *A. t.* Nutt. ssp. *wyomingensis* Beetle & Young) communities in a variety of soil types and vegetation states.*** An examination of population dynamics and seed ecology of rush skeletonweed on burned and unburned plots in shrub steppe communities also was conducted. Burning increased rosette emergence, and most rosettes were from rhizomes rather than from seeds. Many viable seeds were produced, but seedling establishment was episodic and seed banks did not carry over past one year. A comparison of fuel loading characteristics of (a) perennial weeds [rush skeletonweed and squarrose knapweed (*Centaurea virgata* Lam.)], (b) annual weeds (cheatgrass), (c) crested wheatgrass (*Agropyron* spp.), and (d) sagebrush communities in various vegetative states is underway. Four peer-reviewed manuscripts and a GTR are in preparation.
- The effect of fire on squarrose knapweed (*Centaurea virgata* var. *squarrosa*) and its invasion into different communities, as well as the effect of squarrose knapweed on fuel loading, is being examined in central Utah. Due to a regional drought, establishment of squarrose knapweed was limited on the study plots. There were few differences in fuel moisture between cheatgrass sites and cheatgrass/knapweed sites and between crested wheatgrass sites and crested wheatgrass/knapweed sites. ***Fuel moisture content during the first two weeks of the summer was significantly lower in cheatgrass and knapweed when they were growing together than in a monoculture.*** These data are being combined with those for rush skeletonweed to provide information on the regional effects of invasion by knapweeds on fuel loads in sagebrush ecosystems and potential fire behavior. A manuscript and GTR will result from this work.

Issues/Concerns; changes in research objectives, methods, or products: The project is in its last year and most of the original objectives have been met.

2005 JFSP Principal Investigator Workshop

Project Progress Report

00-1-3-01

Project Title: The Use of Landsat 7 (ETM+) and AVIRIS data to Map Fuels Characteristic Classes in Western Ecosystems

Project Location: Yosemite, Glacier, Lassen Volcanic, and Great Basin National Parks, and Devils Postpile National Monument.

Principal Investigators: Jan van Wagtendonk, Carl Key

Contact Information (Phone, e-mail): (209) 379-1306,

jan_van_Wagtendonk@usgs.gov

Brief Description of Project: The accuracy, efficiency, and cost-effectiveness of Landsat 7 Thematic Mapper imagery and Airborne Visible Infrared Imaging Spectrometer (AVIRIS) hyperspectral data for developing fuel characterization classes for a variety of western US ecosystems will be tested using field data collected at Glacier, Yosemite, Lassen Volcanic, Great Basin National Parks, and Devils Postpile National Monument. Plot locations were randomly located by unique NDVI value clusters identified on Landsat 5 TM imagery. A temporal sequence of Landsat 7 scenes will be used to calculate NDVI values for each scene. Broad vegetation types and fuel characteristic classes will be distinguished using seasonal differences in NDVI and ancillary data themes. Data from the plots will be used to establish relationships between fuel characteristics and each NDVI cluster. A similar approach will be used to determine the accuracy and effectiveness of spectrum matching and end member analysis of AVIRIS data.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Fuels and vegetation data from Devils Postpile National Monument were collected as a substitute for Theodore Roosevelt National Park, since those were to have been collected by the deceased co-PI.
- All field fuels and vegetation data have been entered, verified, formatted, and delivered to JFSP cooperators.
- The AVIRIS flight for Great Basin National Park was completed and ground calibration measurements were taken in 2004. Imagery was delivered to UC, Santa Barbara.
- Posters on cooperative work with the Forest Service and UC, Santa Barbara, were presented at the 5th International Workshop on Remote Sensing and GIS Applications to Forest Fire Management at Zaragoza, Spain in June 2005.
- The following peer-reviewed journal article was published:

van Wagtendonk, J. W., R. R. Root, and C. H. Key. 2004. Comparison of AVIRIS and Landsat ETM+ detection capabilities for burn severity. Remote Sensing of Environment 92:397-408.
- The following technical reports were published:

van Wagtendonk, J. W. 2004. Fire and landscapes: patterns and processes. P. 69-78 *in*: Murphy, D. D., and P. A. Stine (eds). 2004. Proceedings for the Sierra Nevada Science Symposium. USDA For. Serv. Gen Tech. Rep. PSW-GTR-193. 278 p.

van Wagtendonk, J. W., Z. Zhu, and E. L. Lile. 2004. Prefire risk assessment and fuels mapping. P. 49-52 *in*: Livingston, R. K., (ed.). Third U. S. Geological Survey Wildland Fire-Science Workshop. USGS Scientific Investigations Report 2004-5005. 67 p

Issues/Concerns; changes in research objectives, methods, or products: Because of the death of the co-PI who was going to do the analysis of the imagery, I have taken steps necessary to complete the project through cooperation with other JFSP projects. Specifically, the project by Jenny Rechel from the Forest Service in cooperation with Dar Roberts from UC, Santa Barbara; Jeremy Fried from the Forest Service at Corvallis; and the LANDFIRE Project.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire Hazard Reduction in Chaparral Using Diverse Treatments
JFSP Project No.: 00-2-02
Project Location: Mendocino County, California
Principal Investigators: James Dawson (BLM) and Scott Stephens (UC Berkeley)
Contact Information: Jennifer Potts, jpotts@nature.berkeley.edu, 510-528-6234

Brief Description of Project:

This project investigates the ecological implications of current California chaparral fire management practices. This research is critically important because social, economic and political pressures are steering fire managers away from maintaining the natural chaparral fire regime. Specifically, managers are often forced to conduct prescribed burns outside of the historical fire season or replace fire entirely with mechanical fuel removal. The ecological consequences of these management practices are largely unknown, but evidence suggests that chaparral plant and wildlife composition may be permanently altered as a result.

To address this issue, we are investigating the effects of fall, winter and spring prescribed fire and mastication in Northern California Coast Range chaparral. With over 100 acres of replicated experimental treatments, this research project is one of the only chaparral studies of its kind. Pre and post-treatment monitoring of plant and bird recovery has been ongoing since 2001 and will continue through fall 2005. Preliminary results already suggest that plant and bird responses vary drastically following these different fuel management treatments, particularly in relation to non-native grass cover and bird abundance. Final project reports and deliverables will be completed by July 31, 2006.

Status Report:

Accomplished science delivery:

- May 2003: 60+ federal, state and local agency representatives attended a presentation and site tour at the University of California Hopland Research & Extension Center.
- October & December 2004: Presentations/field tours were given to Interagency Resource Advisory Councils from Ukiah and Eureka, CA.
- May 2005: Site tours were given to University of California faculty, extension specialists and advisors.
- Year-round: Self-guided site tours are available at the UC Hopland Research & Extension Center.
- Preliminary webpage is available at <http://cnr.berkeley.edu/stephens-lab/chaparral/index.htm>

Planned science delivery:

- October 2005: Presentation at the Tall Timbers 23rd Fire Ecology Conference, Oklahoma
- November 2005: Presentation, 3rd International Fire Ecology and Management Congress, San Diego
- Professional presentations, site tours and journal articles will be available as data analysis continues.

Issues/Concerns; changes in research objectives, methods, or products:

We extended the period of data collection to 5 years (instead of 3 years) in order to capture longer-term trends. As a result, the final analysis will be completed in 2006.

2005 JFSP Principal Investigator Workshop

Project Progress Report

00-7-06

Project Title: Conversion of upland loblolly pine-hardwood stands to longleaf pine: does it influence fuel load, restore native forest cover, and reduce fire danger

Project Location: Southern Research Station (SRS), RWU-4111, Alexandria Forestry Center, 2500 Shreveport Highway, Pineville, Louisiana 71360

Principal Investigators: James D. Haywood and Tessa A. Bauman, USDA Forest Service, SRS; Richard A. Goyer, LSU Agricultural Center; and Finis L. Harris, USDA Forest Service Ouachita NF

Contact Information (Phone, e-mail): Voice: 318-473-7226, Fax: 318-473-7273, E-mail: dhaywood@fs.fed.us

Description of Project: Without continual burning, midstory and understory woody vegetation evolves beneath pine overstories, and the accumulating litter and midstory of ladder fuels create a high fire hazard. In this Joint Fire Science Program demonstration project, we evaluated how several management schemes change fuel conditions and vegetative composition in three upland forest types (loblolly pine, mixed pine, and young longleaf pine plantation) that were at different stages of restoration to longleaf pine.

We established six 10-hectare Demonstration Areas. As originally proposed, we initiated three randomly assigned treatments to about a third of each area: (a) no treatment, (b) prescribed burning, and (c) prescribed burning plus supplemental woody plant control by mechanical means. We collected pre-burn fuel samples, prescribed burned the plots during spring 2001 and 2003, and collected post-burn samples 6 weeks after each burn. We completed the understory and midstory vegetation surveys in 2001, 2003, and 2004 (14 months after the last burn). We mechanically treated brush in summer 2002.

We measured the overstory trees at the beginning and end of the project period. In addition to the original project, we evaluated the effects of the fires on bark beetle populations.

Status Report: As expected, burning destroyed most of the live foliage in the understory across our sites, but the effect was short term and the understory vegetation recovered between burns. Burning also reduced the amount of 1-hour and 10-hour time-lag dead fuels, but dead fuels accumulated between burns. In May 2001, there were 4330 and 3345 kg/ha of 1-hour fuels on the no burn and prescribed burned plots, and in August 2004, there were 3475 and 2435 kg/ha of 1-hour fuels on the no burn and prescribed burned plots, respectively. Therefore, 1-hour fuel loads were unaffected by burning 14 months after the second prescribed burn. Burning affected 10-hour time-lag dead fuel loads, however. In May 2001, there were 5190 and 6575 kg/ha of 10-hour fuels on the no burn and prescribed burned plots, and in August 2004, there were 3680 and 2165 kg/ha of 10-hour fuels on the no burn and prescribed burned plots, respectively. Burning has not influenced mid or overstory composition. Mechanical brush control did not affect live fuels, 1-hour, and 10-hour fuel loads, but it did remove the midstory vegetation thereby eliminating ladder fuels.

Southern pine beetle (*Dendroctonus frontalis*) and Ips engraver beetle (*Ips* spp.) are the most destructive group of insects in the pine forests of the southern United States. Therefore, a prime concern is a reduced resistance to such bark beetles in fire-stressed stands because bark beetle populations often increase following prescribed burning. Additionally, ambrosia beetles (*Platypodidae*) are often attracted to fire-stressed stands and are vectors of known and suspected root pathogens. In the mixed pine and loblolly pine stands, prescribed burning resulted in increased numbers of beetles. Principally the beetles trapped were in three guilds--ambrosia beetles, bark beetles (*D. terebrans*, *Hylastes tenuis* and *salebrosus*, *Ips grandicollis* and *arulsus*), and weevils (*Cossonus corticola*, *Hylobius pales*, and *Pachylobius picivorus*). No southern pine beetles were trapped, but the majority of weevils trapped were *C. corticola*, which is an associate of the southern pine beetle. Too few ambrosia beetles were trapped to determine response trends.

Deliverables: In the proposal, we stated that we would incorporate results into journal publications and a Southern Silvicultural Research Conference Proceedings paper. Publications would be made available in electronic format through the USDA Forest Service, Southern Research Station website, and the posters would be presented at Longleaf Alliance meetings, workshops, conferences and other outlets. To date (June 2005), we have produced three posters and two publications for a Fire Council Meeting, Longleaf Alliance Conference, and the 12th Biennial Southern Silvicultural Conference, which are available on the internet at "www.srs.fs.usda.gov/4111/techtrans.htm".

The final results are being prepared for journal publication(s). Pending papers will be posted on the internet and sent to the JFSP for its use. Meta data files are being prepared for FRAMES as the final data sets are incorporated into the manuscript(s).

Therefore, we have produced, or are in the process of producing, all of our deliverables. In addition, we have made presentations at Forest Service workshops and conducted several tours to our demonstration sites. Our goal is to maintain the demonstration areas for future tour use. Overall, the JFSP project has been an important addition to our research effort, and our sites have been valuable in visualizing fire effects within the longleaf pine type. Our project has also been a springboard for other research work funded through other sources.

Summary: Our objective was to demonstrate changes in fuel load condition as upland pine-hardwood forests are converted to longleaf pine-grassland habitats. We have measured the effects of two burning cycles on fuel loads, vegetation, and insect populations, and we have been able to determine the effectiveness of our treatments. I believe we have met or exceeded the project's objectives, as we continue to make our research results available through future publications and presentations.

Issues/Concerns affecting the project: The project fieldwork is completed. We finished all of our original objectives and completed the insect work as well, which was not originally part of the project. Hopefully, we will complete the final documents by Jan 2006.

2005 JFSP Principal Investigator Workshop

Project Progress Report

00-2-30

Project Title: Fire Hazard Reduction in Ponderosa Pine Plantations

JFSP Project No.:

Project Location: Groveland District of the Stanislaus National Forest, Groveland, CA

Principal Investigators: John Swanson, Scott Stephens, Ken Blonski

Contact Information (Phone, e-mail): stephens@nature.berkeley.edu, jrswanson@fs.fed.us

Brief Description of Project:

High severity wildfires are common in the Stanislaus National Forest, located in the central Sierra Nevada mountains of California. Ponderosa pine and other types of plantations add to the complexity of forest fire management because of their high fire hazard and the potential for fire spread to adjacent natural stands, as well as concerns over plantation health and commercial viability. Plantations are more susceptible to fire than natural stands, reducing the likelihood that they will reach a mature age. The effects of various fuel treatments, including mechanical thinning, mastication, and use of prescribed fire are not fully understood in reforested areas. Various ages of plantations will benefit from and react differently to various types of treatments. The objective of this study is therefore to contrast the efficacy of mechanical thinning and mastication methods with and without prescribed burning in reducing fire hazard severity in ponderosa pine plantations. In achieving the primary objective, several secondary objectives will be addressed, including the effect of the treatment on (1) fire hazard reduction, (2) vegetation response, (3) potential fire behavior, and 4) costs and benefits. Pre-treatment vegetation data has been collected in all units, and post-treatment stand characteristics will continue to be measured. Technology transfer will occur with a combination of written materials, a worldwide web site, and a self-guided "drive-walk" route. In addition, we will use carbon efflux measurements to document how these fuels reduction treatments affect soil carbon respiration rates and sensitivity to environmental variables. Our research will explore the importance of vegetation structure and proximity, and soil physical and chemical factors in influencing these rates.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): This Spring marked a long-awaited success in project implementation with the application of prescribed fire. Together with UC Berkeley investigators, the USFS administered prescribed burning in three stands, two of which had been mechanically masticated the year before. All research units included in these stands were burned during the same day under similar fuel moisture and weather conditions, thereby substantiating the quality of these fires as replicates. Fire behavior and weather data were monitored during the burns, and post-fire stand and fuels characteristics were inventoried.

Preliminary results suggest:

- The prescribed burns in each stand lowered surface fuel loads from post-mastication levels.
- In masticated stands, fuel loads following combined mastication and fire treatments were not consistently lower when compared to pre-treatment loads, especially in 10- and 100-hr timelag fuel categories and duff weights.
- In the burn-only stand, overall surface and ground fuel loads were reduced by fire.
- Post-fire soil carbon respiration rates increased immediately following burning, and are slowly returning to pre-burn levels (data collection is on-going).

The research objectives and goals of these prescribed burns were publicized in another front-page article in the *Sonora Democrat*, a local newspaper, on June 30, 2005.

The USFS Groveland Ranger District released the contract for mechanical thinning and biomass removal in the Spring of 2004, and awarded this contract to Sierra Resources, Inc., who began thinning treatments during July of 2005. All stands slated for thinning under the JFSP study description have been prioritized for treatment, including 251 acres in the first tier and 556 acres thereafter. Following treatments, data will be gathered to address the changes in fuel loads and composition, to address the costs and benefits of the treatments, and to model potential fire behavior and tree mortality associated

with prescribed fire. At that point, all results will be analyzed and interpreted and management implications will be addressed. Research stands slated for cut-to-length and whole-tree-removal thinning should be treated by the end of this year.

Issues/Concerns; changes in research objectives, methods, or products: As mentioned above, we were very pleased with the successful implementation of the prescribed burns on the district. The final treatment, thinning, is now underway. We look forward to providing a final report following the thinning treatments. Our original objective was to contrast the efficacy of 5 fuels reduction treatments, and, although our timetable has been extended due to various circumstances, we will soon meet this goal and more. Our collection of soil carbon respiration data three years before as well as following the fuels treatments is unprecedented, to our knowledge. We believe the documentation and analysis of the effects of prescribed burning on soil carbon efflux will prove interesting to managers and fire, atmospheric, and soil ecologists alike.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Restoring Mixed Conifer Ecosystems to Pre-fire Suppression Conditions in Crater Lake National Park

JFSP Project No.: 00-2-31

Project Location: Crater Lake National Park, OR

Principal Investigators: James K. Agee

Contact Information (Phone, e-mail): jagee@u.washington.edu

Brief Description of Project: A total of 24 experimental units were established near Highway 62 in Crater Lake National Park to demonstrate fuel reduction treatments from spring and fall burns: 8 were control units, 8 were spring burns, and 8 were fall burns. Treatments were completed in 2002. Fuel reduction, forest structure, and oleoresin were measured to compare effects of spring and fall burns.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Project was completed in 2004. Before burning, dead and downed fuel averaged 151 Mg/ha. Spring burning reduced this load by 27 Mg/ha (18%), while fall burns reduced loads 72.8 Mg/ha (52%). Burning increased height to live crown by 0.8 m in spring units and 2.7 m in fall units. A total of 1725 old ponderosa pine trees were identified, tagged, and measured for diameter and crown vigor. Mortality was higher in fall burns than spring burns, and was associated with crown vigor. Oleoresin volume and pressure were higher in burned trees than controls soon after burning. Mortality of large, old pines continues into 2005.

Issues/Concerns; changes in research objectives, methods, or products: A M.S. thesis by Dan Perrakis has been completed. A final report on interpretation of the fuel demonstration project has been submitted to the park (November 2004), and a manuscript is in final stages of review with the Canadian Journal of Forest Research. In June 2005, Mr. Perrakis made a presentation at the AAAS meeting in Ashland OR and won an award for best student presentation. Continuation of the oleoresin work will be possible with JFSP project 05-2-1-92, funded in June 2005.

JFSP 2004 Principal Investigator Workshop

W-2-32

Project Title: Fire Effects and Fuel Management in Blackbrush (*Coleogyne ramosissima*) Shrublands and Invasive Annual Grasslands of the Mojave Desert

Project Location: Joshua Tree National Park (NPS, CA), Spring Mountains National Recreation Area (USFS, NV), and the St. George Field Office (BLM, UT)

Principal Investigators: Matt Brooks, Todd Esque, Tim Duck, and Tom Patterson

Contact Information (Phone, e-mail): 702-564-4615, matt_brooks@usgs.gov

Description of Project:

This project began as a fuels management study of invasive annual grasses in the Mojave Desert. However, five years of low rainfall from 1999-2003 failed to produce the appropriate fine fuel conditions to treat alien annual grasses with herbicides or other management prescriptions. We therefore shifted the focus of the study to another major fuel management concern in the Mojave, after receiving permission from the JFSP Board of Directors. The new project focus was on the management of fuels created by blackbrush (*Coleogyne ramosissima*). In the past, fire has been used as a fuels treatment to reduce blackbrush cover. However, concerns about the effects of burning on plant community structure, and the desire to find alternative ways to manage blackbrush fuels, led to a cessation of burning as a fuels treatment in the early 1990s. This project was designed to provide managers with the information needed to determine the best approach to managing these types of fuels.

We first compared the vegetation characteristics of previously burned and unburned blackbrush at sites in CA, NV, and UT. We then worked with fire managers at the BLM St. George Field Office and Joshua Tree National Park to design a mechanical thinning treatment for blackbrush. Thinning treatments were implemented during winter 2003-2004 in southwestern UT. Implementation monitoring was done along with the treatments to quantify their specific characteristics. Effectiveness monitoring was done during spring 2005 to evaluate their year 1 effects on plant community structure and fuel characteristics. Soon afterwards in summer 2005, a wildfire burned through the entire study area. We have plans to quantify fuel consumption and other correlates of fire behavior during fall 2005 to determine if fire behavior differed between blackbrush stands that were thinned versus those that we left unthinned.

Status Report:

Products

- Brooks, M.L. and J.R. Matchett. 2003. Plant community patterns in unburned and burned blackbrush (*Coleogyne ramosissima*) shrublands in the Mojave Desert. Western North American Naturalist 63:283-298.
- Brooks, M.L. et al. In preparation. Annual Plant Seedbanks in Unburned and Burned Blackbrush (*Coleogyne ramosissima* Torr.) Shrublands in the Mojave Desert
- Evaluation of fire behavior in thinned and unthinned treatment plots
- Website soon to be posted at <http://www.werc.usgs.gov/fire/lv>
- Numerous presentations on the topic

The project ended, and a final report was submitted at the end of FY05

Issues/Concerns affecting the project:

None, aside from the need to shift the focus of this study, although this has already been approved by the JFSP Board of Directors.

The first part of the paper discusses the general theory of the subject, and the second part discusses the particular case of the subject. The first part is divided into two sections, the first of which discusses the general theory of the subject, and the second of which discusses the particular case of the subject. The second part is divided into two sections, the first of which discusses the general theory of the subject, and the second of which discusses the particular case of the subject.

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2005 JFSP Principal Investigator Workshop

Project Progress Report

01-1-3-19

Project Title: Effects of Fuels Reduction and Exotic Plant Removal on Vertebrates, Vegetation and Water Resources in the Middle Rio Grande Bosque

Project Location: Middle Rio Grande (Bernalillo, Valencia, and Socorro Cos, NM)

Principal Investigators: Deborah Finch, Alice Chung-MacCoubrey, Heather Bateman, Dave Merritt, and Roy Jemison, USDA Forest Service, Rocky Mountain Research Station (RMRS)

Contact Information (Phone, e-mail): 505-724-3671, dfinch@fs.fed.us

Brief Description of Project: Our research is designed to test effects on target and non-target species of three fuel removal treatments in river woodlands invaded by heavy thickets of exotic woody plants. Tamarisk and Russian olive contribute to high fuel loads on the Rio Grande and many southwestern river and stream systems. Many wildlife species have adapted to the presence of these non-natives, and removing them to reduce fire risk may have both positive and negative effects. Treatments are implemented in a randomized block design over 12 50 acre study sites and include 1) mechanical removal of dead, down, and exotics, 2) mechanical removal followed by re-vegetation with native plants, and 3) mechanical removal followed by prescribed fire. Fuel loads, native plants, birds, bats, reptiles, and water quantity are monitored before and after treatments. Treatment costs are sponsored by the Collaborative Forestry Restoration Program (Forest Service S&PF), Middle Rio Grande Conservancy District, City of Albuquerque, and U.S. Fish and Wildlife Service.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): Treatments have taken longer to implement than originally estimated and mechanical, fire and revegetation treatments were finally completed in spring 2005. In summer of 2005, the project moved into the post-treatment monitoring phase. Preliminary results from monitoring of habitat, fuel loads, and wildlife during the pre-treatment and treatment phases were summarized in the FY2004 Annual Report for the Fuels Reduction Project distributed in March 2005. Fuel data and habitats (stems/acre, % cover of plant species, canopy cover, foliage density, dbh of stems) were measured prior to treatment at all 12 sites and compared to data collected at sites treated in 2003-4. Investigators presented 2 project papers at the Monitoring Science and Technology Symposium in Denver, CO. Symposium proceeding are scheduled to be published in December 2005. One poster was presented at the 2005 National Fire Plan Conference in Albuquerque, NM. Hydrologist Roy Jemison moved to a new job, and hydrological research will continue using a Research Joint Venture with University of New Mexico's Water Program (contact Mike Campana). Researchers secured supplemental funding for the 2005 summer field season through competitive grants from the University of New Mexico, the National Fish & Wildlife Foundation, T&E Inc., the USDA Forest Service, Middle Rio Grande Ecosystem Management Project, and the U.S. Fish and Wildlife Service's Bosque Improvement Initiative.

Issues/Concerns; changes in research objectives, methods, or products: The time and costs of implementing treatments are greater than originally estimated. A request for an agreement extension is requested.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Cumulative Effects of Fuel Management on Landscape-Scale Fire Behavior and Effects

JFSP Project No.:01-1-3-21

Project Location: Missoula, Montana

Principal Investigators: Mark A. Finney

Contact Information (Phone, e-mail): 406.329.4832, mfinney@fs.fed.us

Brief Description of Project:

The project is concerned with modeling the long-term effects of landscape fuel treatment patterns on wildfire sizes and severity. The work was initiated based on theoretical fuel treatment patterns that appeared effective at changing fire growth across large landscapes, thus reducing the acreage burned and the chances that large fires starting far from urban interface areas will reach them. To model long-term effect, vegetation/fuel dynamics are simulated using a custom version of FVS PPE (parallel processing extension), a fire growth simulation model similar to *FARSITE*, and a spatial fuel treatment optimization program developed for this project. Simulations are run into the future for 50 years to examine the effects of implementing spatially optimized fuel treatment patterns on fire sizes, burn probabilities, and fire growth rates. These response variables are compared for random arrangements of treatments as well. Effects of spatial constraints on placement of fuel treatments (e.g. stream corridors, private lands, wildlife restrictions on treatments) on treatment performance are also studied. Study sites are located in western Montana, the Sierra Nevada of California, and eastern Oregon.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The simulation system consisting of FVS PPE and fuel treatment optimization has been developed and run for all study sites.
- Fuel treatment optimization completed and integrated into FlamMap software, documentation in development.
- Rules for determining fuel characteristics from FVS output have been refined for all study sites.
- Runs done for all study sites for optimized scenarios (different percentages of treatment), random treatment, but none done with constraints
- Results for all landscape have same trends as theoretical patterns, showing that pattern is very important to short- and long-term treatment effectiveness as measured by fire sizes, burn probabilities, and fire growth rates
- All runs will be completed and results presented by May 2006.
- Alternative approach also developed to optimize fuel treatment patterns by integer programming

Issues/Concerns; changes in research objectives, methods, or products:

- Project on schedule to finish by May 2006 (after 1-yr no-cost extension)
- Modeling system is complex, probably will remain a research tool. The nature of the modeling problem (i.e. fuel and fire dynamics in space and time) may not be practical for general planning uses by managers because of the wide range in expertise required (fire behavior modeling, vegetation dynamics modeling (FVS), GIS analysis, computer programming).

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: The use of high-resolution remotely sensed data in estimating crown fire behavior variables

JFSP Project No.: 01-1-4-07

Project Location: Capitol State Forest, WA, and Mission Creek Fire and Fire Surrogates (FFS) site, WA

Principal Investigators: Dr. Gerard F. Schreuder and Dr. James Agee

Contact Information (Phone, e-mail): Dr. Hans-Erik Andersen 206-685-3073

hanserik@u.washington.edu

Brief Description of Project: The emergence of a new generation of high-resolution remote sensing systems in recent years could potentially allow for more accurate and efficient estimation of crown fire behavior variables. With spatial resolutions often falling in the sub-meter range, the spatial data provided by these sensors can support more detailed measurement of the forest canopy structure, which in turn can increase the accuracy and effectiveness of existing fire behavior models. In particular, the ability of active infrared (laser) and microwave (radar) airborne sensors to acquire direct, three-dimensional measurements of canopy structure can significantly improve estimation of the quantity and distribution of crown fuels (crown bulk density, canopy base height, stand height). However, there is a need for the development of analytical techniques and algorithms to automatically and efficiently extract the required information from the enormous quantity of data provided by these high-resolution remote sensing systems, as well as to assess their utility and cost-effectiveness for the application of fire behavior modeling. The objective of this project is to carry out an extensive investigation of the utility of A) active infrared (LIDAR) sensor data and B) active microwave (IFSAR) sensor data for the estimation of crown fire fuel density, type and condition. This project will complement and support JFSP –funded fuels mapping and characterization efforts currently underway at the national, state, and local levels.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- All field plots have been established at Capitol State Forest and Mission Creek study areas
- Field plots have been precisely georeferenced using differential GPS and laser surveying equipment
- High-density LIDAR data have been collected at Capitol State Forest (2003) and Mission Creek (2004) study sites
- Multifrequency (X-band/P-band) high-resolution IFSAR data have been collected at Capitol State Forest (2002)
- LIDAR/IFSAR data visualization software (*FUSION*) is currently in development

- Preliminary results indicated high correlations between LIDAR-based metrics and field-measured plot-level fuel estimates (canopy height: $R^2=0.98$; canopy base height: $R^2=0.87$; canopy bulk density: $R^2=0.85$; canopy fuel weight: $R^2=0.87$)
- Preliminary results also indicate high correlation between IFSAR metrics and field-based plot-level fuel estimates (canopy height: $R^2=0.88$; canopy base height: $R^2=0.87$; canopy bulk density: $R^2=0.78$; canopy fuel weight: $R^2=0.80$)
- The LIDAR-derived digital terrain model was found to be highly accurate, even under dense forest canopy (overall root-mean-square-error of 0.32 m at the Capitol Forest study site)
- The IFSAR P-band digital terrain model was found to be much more accurate than the standard USGS topographic data at the Capitol Forest site (overall root-mean-square-error of 2.6 m at the Capitol Forest study site)
- Relationships developed can be used to generate spatially-explicit fuel maps in GIS format
- LIDAR and IFSAR processing routines are currently under development, and should be available to managers by early 2006.

Issues/Concerns; changes in research objectives, methods, or products: The X-/P-band IFSAR flights over the Mission Creek FFS study site were cancelled due to FCC-imposed restrictions on the P-band waveform, which will severely degrade the quality of the IFSAR-derived terrain models. We are currently exploring the possibility of acquiring high resolution X-band IFSAR data over the study site in 2006.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire Effects on Regional Air Quality Including Visibility

JFSP Project No.: 01-1-5-01

Project Location: Fort Collins, Colorado (applicable to western US)

Principal Investigators: Dr. William C. Malm, NPS & Dr. Douglas G. Fox, CIRA

Contact Information (Phone, e-mail): 970-491-8292; fox@cira.colostate.edu

Brief Description of Project:

Forest burning contributes to regional haze in western National Parks and Wilderness. Regional haze regulations and standards for ozone and PM_{2.5} require quantification of smoke emissions and their impact. This research work attempts to quantify impacts of smoke (the organic component of fine particulate aerosols) on regional air quality. Fire smoke emissions inventories that are available for selected periods and regions developed for regional air quality modeling purposes, are used to diagnose regional haze using measured IMPROVE data and regional models. This research will help managers participate with air quality regulatory agencies to define appropriate control strategies for forest burning.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

1. Review regional inventory for forest fire emissions to be used in model evaluations. We will review existing fire inventories, including WRAP developed 1996, 2002 and typical fire regional emissions inventories and an inventory generated from the "Community Smoke Emissions Model" which we developed with additional support from the US EPA. The review should help managers establish the accuracy needed for future emissions inventories.
2. Using this inventory for air quality modeling. An update on our progress was presented at a recent scientific conference (Combining Wildfire Emissions From The Community Smoke Emissions Model (CSEM) With A Regional-Scale Air Quality Model by Barna & Fox). We have installed and have completed evaluating REMSAD, a regional air quality model for its applicability to visibility applications in the western US with funding from the BRAVO project looking at air pollution effects in Big Bend National Park. A comprehensive report is available. We are in the process introducing fire emissions into REMSAD over the coming year. A publication documenting results will follow.
3. Evaluating effects of fire on regional air quality using monitoring data. IEWS, developed with funding from the RPOs, provides IMPROVE and other aerosol data in a web based data analysis system. We reported results of using these data to develop preliminary estimates of wildfire effects on regional air quality. (Ames et. al. 2004. Preliminary apportionments of carbonaceous aerosols to wild fire smoke using observations from the IMPROVE network. Regional Haze paper # 76; AWMA 2004, Asheville, NC).

Issues/Concerns; changes in research objectives, methods, or products:

Because of unanticipated delays in validating and evaluating the regional air quality model as well as a continuing delay in the availability of regional fire emission inventory data this project is behind schedule. However, it will be completed during 2005.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Automated Forecasting of Smoke Dispersion and Air Quality Using NASA Terra and Aqua Satellite Data (Task 5)

JFSP Project No.: 01-1-5-03

Project Location: Missoula, Montana; Silver Spring, Maryland

Principal Investigators: Shawn Urbanski and Wei Min Hao

Contact Information (Phone, e-mail): (406) 329-4829, surbanski@fs.fed.us

Brief Description of Project: Wildland fires are a major contributor of particulate matter and other pollutants to the atmosphere. The new EPA Clean Air Act and the Regional Haze Rule require quantifying accurately the emissions of PM_{2.5} and other pollutants from fires and their impacts on regional haze and air quality. We are developing an automated system that will forecast smoke dispersion and air quality in the continental U.S. The forecasting system assimilates real-time NASA Terra and Aqua satellite data on active fire locations and burned areas into the *FARSITE* fire behavior model and the HYSPLIT-CheM forecast model. Our goal is to provide land and air quality managers with the capability to predict smoke dispersion and PM_{2.5} and other pollutant concentrations every 6 hours for the next two days.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The HYSPLIT-CheM hybrid model has been implemented and tested in the context of the New England 2002 Forecasting Pilot Program to calculate ozone concentrations.
- A set of algorithms was developed and revised for detecting burn scars in real-time using single MODIS scenes from the NASA Terra and Aqua satellites. Daily burned scars, in addition to fire locations, for most of North America are posted on the web site.
- Codification of the subroutines involving the CB-IV photochemical mechanism has been refined and simplified in order to be delivered for its installation in a Linux cluster.
- HYSPLIT-CheM has been parallelized to take advantage of multiple processors if available. Streamlining the parallelized code is an ongoing effort.
- The computer system on which the model will run has been acquired, installed, and configured at the Fire Sciences Laboratory in Missoula, MT.
- We have begun integrating the *HYSPLIT-CheM-Smoke Dispersion* model components.
- Air quality managers will be able to use the HYSPLIT-CheM-Smoke Dispersion forecasted pollutant concentrations on the web site to quantify the contributions of smoke from wildland fires to regional haze and air quality.

Issues/Concerns; changes in research objectives, methods, or products:

The original plan of this project was to produce a modeling system capable of being deployed to the end user, which could run on a small cluster (four processors) by the end user. The main problem with this scenario involves the logistics of transporting the initialization data to the end user so that the run can begin. Updated hotspots and burn scars from the MODIS instrument on the Terra and Aqua satellites can indeed be provided in near real-time. However, the meteorological initialization data must also be downloaded by the user, and this data set is quite large. For the revised plan, the actual HYSPLIT-CheM-Smoke Dispersion model will be run at the Fire Sciences Laboratory which has a speedy internet connection and which already has the meteorological initialization data. This approach is a far better use of

resources compared to continually update all end users with the latest hotspots, burn scars, and meteorological inputs. Rather than produce a program for users to download, install, run and maintain, we will provide a web site which will permit them to enter their burn information and view the results.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Photo Series for Major Natural Fuel Types of the United States—Phase III

JFSP Project No.: 01-01-7-02

Project Location: Pacific Wildland Fire Sciences Laboratory, Seattle, Washington

Principal Investigators: Roger D. Ottmar

Contact Information (Phone, e-mail): (206) 732-7826; rottmar@fs.fed.us

Brief Description of Project: The natural fuels stereo photo series is a collection of georeferenced data and photographs that display a range of natural conditions, fuel loadings, and other fuelbed characteristics in a wide variety of forest-, woodland-, shrub-, and grass-dominated ecosystem types. The photo series are useful tools for quickly and inexpensively evaluating vegetation and fuel conditions in the field. The objective of this project was to continue the development of the Natural Fuels Photo Series to include up to six additional fuelbed types not covered by previous projects.

Older photo series were reviewed and a needs assessment was conducted among managers and scientists to determine the fuelbed types and elements for inclusion in this project. A total of 8 fuelbed types were selected resulting in two large photo series volumes, including: (1) Volume VIa: Sand hill, sand pine scrub, and hardwoods with white pine types in the Southeast United States with supplemental sites for Volume VI, and (2) Volume VIII: hardwood, pitch pine and red spruce/balsam fir types in the northeastern United States. Volume VIa can be purchased from the National Interagency Fire Center, Publication Management System. Volume VIII will be available from NIFC when the printing is completed. Data collected for this photo series effort allowed the Fuel Characteristic Classification System (JFSP 98-1-1-06) to be more robust and include more fuelbed types in historically data-poor fuel types across the United States.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Science Deliverables:
1. One photo series volume containing five fuelbed types with 26 sites; one photo series volume in draft form nearly ready for review and printing. Expected availability is late 2005.
 2. Three JFSP progress reports
 3. Website link to the photo series project at:
<http://www.fs.fed.us/pnw/fera/photoseries/>
 4. RX-410 photo series training package
 5. Ten poster presentations and published abstracts
 6. Four presentations at various conferences
 7. Final report

- Applications:
1. Developed RX 410 training package on how to use the photo series.
 2. 35 photo series presentation and exercises at RX 410 (Smoke Management), RX 300, (Burn Boss), and RX 310 (Fire Effects) national and regional training sessions.

Management: The photo series are useful tools for quickly and inexpensively evaluating vegetation and fuel conditions in the field. Thousands of managers use the photo series to reduce the time and effort to estimate fuel loadings for fire and fuels planning.

Issues/Concerns; changes in research objectives, methods, or products: None. The project was completed and final report and 1 photo series (Volume Via) delivered in June 2005. The second photo series (Volume VIII) will be available when the printing is complete.

2005 JFSP Principal Investigator Workshop

Project Progress Report

01-1-7-03

Project Title: Using the NED decision support system to improve fuels management decision processes.

Project Location: Asheville, NC

Principal Investigator: Dr. H. Michael Rauscher

Contact Information (Phone, e-mail): 828-683-6722; mrauscher@fs.fed.us

Description of Project:

The purpose of this study is to assist fire resource managers to characterize and reduce uncertainty, identify fire risk, and improve decision-making processes in the wildland/urban interface as well as the broader forested wildlands. We propose expanding the existing NED decision support system so that it can be used by fire resource managers to assess and reduce the risk of fire hazard to human life; financial loss of property from a fire incident; and provide an evaluation of the impact of various fuels manipulation/reduction methods on future fire behavior and severity as well as ecosystem function, health, and productivity. This study is composed of 4 major tasks: (1) produce risk assessment guidelines for fuels management in wildland/urban interfaces; (2) provide guidelines for evaluating the impact of fuels management strategies on wildland ecosystems; (3) expand the NED DSS to incorporate new fire risk reduction and fuels management goals; and (4) test the new system using field-based case studies. This study addresses the JFSP RFP-2001-1 task 7 (develop scientifically based support tools) and task 3 (determine cumulative effects of fuels manipulation/reduction).

Status Report:

This report is our final one. After receiving a one year no-cost extension, our money and time runs out in September 2005. Accomplishments for each of the 4 task areas are:

1. fuels management in wildland/urban interface: risk ratings have been prepared for different landscapes, ecosystems, and fuel mixes. Risk assessment procedures have been developed. A scientific paper has been presented and published.
2. fuels management in wildland ecosystems: guidelines have been developed for impact of fuels manipulation/reduction methods on fire behavior and severity. Risk assessment procedures have been developed. A scientific paper has been presented and published.
3. The NED-2 decision support system has been changed to implement 1 and 2 above into a hazard rating system. New goals have been defined for the decision process. First version became available for testing in June 2005.
4. User evaluation of finished product: the user evaluation test is currently underway. We will submit a separate final report at the conclusion of the user evaluation study.

In summary, we have accessed the scientific literature and found and organized what is known concerning fuels management and fire risk ratings. We have put this into an assessment system and then designed goals for inclusion into NED-2. The evaluation test is still underway.

Published Materials:

- Hemel, Brian. 2004. Prescribed burning in Tennessee: barriers, goals, and information needs for private, state, and federal managers. Masters Thesis, University of Tennessee, Knoxville, TN, 31 pp.
- Routh, Cy. 2004. The NED-2 forest ecosystem management DSS: the integration of wildfire risk and GIS agents. Masters Thesis, University of Georgia, Athens, 108 pp.

Hemel, B.T., C.K. Routh, D.S. Buckley, A.J. Long, H.M. Rauscher, W.G. Hubbard, and D.E. Nute. 2005. Development of a wildland fire component for the NED decision support system. In: EastFIRE Conference Proceedings; EastFIRE Conference; George Mason University; May 11-13, 2005; Fairfax, VA. 4 P. (CD).

Alan J. Long, Michael Rauscher, Wayne Zipperer. 2005. Enhancing the NED Decision Support System with wildfire risk assessments. In: EastFIRE Conference Proceedings; EastFIRE Conference; George Mason University; May 11-13, 2005; Fairfax, VA. 4 P. (CD).

Issues/Concerns affecting the project:

Our funding for this project ends September 30, 2005. The 2005 Cooperators meeting, originally planned for spring of 2005 was canceled and rescheduled for November 2005. This prevents us from attending this meeting due to a shortage of travel funds.

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: Two demonstration sites in Northern Arizona for forest thinning, fire use, and fire surrogate treatments in the ponderosa pine type

JFSP Project No.: 01-3-1-06

Project Location: Flagstaff, AZ

Principal Investigators:

Edward B. Smith

Forest Ecologist

The Nature Conservancy

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Brief Description of Project:

We are developing two demonstration sites to promote thinning, prescribed fire, and fire surrogate treatments in ponderosa pine forest types in the Coconino and Kaibab National Forests. The demonstration sites will also serve as applied training opportunities in conjunction with the National Prescribed Fire Training Center (NPFTC) in Florida and the Interagency Fire Use Training Academy (FUTA) in Albuquerque. The first demonstration site is in the Flagstaff Wildland-Urban Interface (FWUI), to provide technology transfer among fire researchers, fire practitioners, other land managers, politicians, and the general public. The other demonstration site is at The Nature Conservancy's Hart Prairie Preserve (HPP), where fire practitioners are using fire as an ecological restoration tool benefiting rare, declining, and common, representative species and communities. This demonstration site emphasizes wildland fuels management issues, and the interpretation of fire use for ecological objectives, including improvement of forest and grassland composition and structure, watershed and wetland improvement, and changes to wildlife habitat quality.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Field data from fuels reduction effectiveness of different treatments ongoing this summer.
Literature review of SW ponderosa pine historic range of variation, and thinning and burning treatments almost complete.
Literature review of SW mixed conifer historic range of variation, and thinning and burning treatments complete and in review.
Signage for Greater Flagstaff Forests Partnership demo site in review, and nearing completion.

Web materials near completion.

Issues/Concerns; changes in research objectives, methods, or products:

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: Prescribed Fires in Mid-Atlantic Coastal Plain Forests

JFSP Project No.: 01-03-02-03

Project Location: Cambridge, MD and Chincoteague, VA

Principal Investigators and contact information:

- Oliver H. Pattee, Ph.D., Research Wildlife Biologist, USGS Patuxent Wildlife Research Center, phone: (301)-497-5741, e-mail: hank_pattee@usgs.gov
- Carol I. Bocetti, Ph.D., Professor, California University of Pennsylvania, phone: (724)-938-5967, email: bocetti@cup.edu
- Laura R. Mitchell, Regional Fire Biologist, Prime Hook NWR, phone: (302)-684-5401, e-mail: laura_mitchell@fws.gov
- Dixie L. Birch, Ph.D., Supervisory Wildlife Biologist
Chesapeake Marshlands National Wildlife Refuge Complex (Blackwater NWR), phone: (410)-228-2692, ext. 118, email: dixie_birch@fws.gov

Brief Description of Project: Blackwater and Chincoteague National Wildlife Refuges, USGS Patuxent Wildlife Research Center, Maryland Department of Natural Resources, and University of Maryland-Eastern Shore, are working cooperatively to study the effects of prescribed fires on mid-Atlantic coastal plain forests, 2002-2005. The study is being conducted on four pairs of 50-acre plots: two at Blackwater NWR, one at Chincoteague NWR, and one at Linkwood WMA. Our intent is to evaluate the effects of a prescribed burn on several variables including endangered Delmarva fox squirrel densities/movements, vegetation composition/structure, and hazardous fuel loads. Our working hypothesis is that prescribed fire will enhance these habitats by opening the forest understory (reducing stem density), and reducing hazardous fuels.

Status Report:

- Each study site was divided into a treatment (burn) and a control (no burn) with 30 points randomly selected in each treatment or control for vegetation/fuels/fire behavior/fire effects data collection.
- Additional USFWS funds were obtained to conduct comparative breeding bird surveys among each treatment and control. A minimum of 15 out of 30 points in each treatment or control was designated for bird point counts. Bird point counts were conducted each June of 2002, 2003, 2004, and 2005.
- During June-September of 2002 and 2003, the following vegetation parameters were measured, per sampling point: archival photographs (to compare relative understory vegetation density), ground flora (density and dominance of plants < 25 mm DBH), woody flora (density of all woody species $\geq$ 25mm DBH), understory flora (vegetative cover 0-2 m above ground), canopy and burn cover.
- Voucher specimens were collected for all plant species identified within the plots, and target woody species were tagged for mortality analysis. Standard (Brown's) fuel loading estimates were made per sampling point. During June-October 2002 and 2003, we sampled live fuel/duff/soil moisture in each treatment and control.
- During spring 2002, 2003, 2004, and 2005 Delmarva fox squirrels were captured, PIT-tagged, and released. Additionally, 5 adult fox squirrels in each treatment or

control were collared with radio transmitters and tracked to determine movements and home ranges pre- and post-burn.

- Due to severe drought and fire restrictions, planned prescribed burns for fall 2002 were cancelled. After all cooperators were consulted, burn treatments were rescheduled for spring 2003. Weather conditions at the 3 inland sites (Blackwater NWR, Linkwood WMA) became and remained persistently wet throughout the spring, summer, and fall of 2003. In contrast, conditions at Chincoteague NWR met burn prescription, and was burned on May 14 and June 2, 2003. Standard fire behavior and fire effects data were collected at sampling points during and post-burn at Chincoteague. No Rx burns were accomplished at Blackwater or Linkwood during spring or fall 2003.
- In anticipation of a fall 2003 burn, all vegetation, fuels, breeding bird, and Delmarva fox squirrel population/home range data collections were repeated. This constituted post-treatment data for Chincoteague NWR, but repeated pre-treatment data for the other 3 study sites. All of the bird, squirrel, vegetation, and fuels data have been entered into Excel spreadsheets.
- The Chincoteague data constituted the core of a Master's thesis, which was completed in 2004, entitled "Effects of Prescribed Fire on Vegetation and Delmarva Fox Squirrel Habitat Use in a Mid-Atlantic Coastal Plain Forest." Approximately 75% of the treatment area was burned, based on char and burn severity information collected. To summarize, (a) canopy tree composition did not change; (b) dominant tree species were loblolly pine (*Pinus taeda*), southern red oak (*Quercus falcata*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), American holly (*Ilex opaca*), and sassafras (*Sassafras albidum*); (c) high bush blueberry (*Vaccinium corymbosum*) plants ≥ 25 mm dbh were reduced significantly by 50% ($P=0.0360$); (d) the greatest impact from the burn was the frequency of plants in the 1-2 m strata with significant reductions of all plants, all trees, all vines, and greenbrier (*Smilax rotundifolia*) in the treatment area; (e) average 95% fixed kernel home range sizes of Delmarva fox squirrels were 3.92 ha pre-burn and 4.98 ha post-burn for females, and 8.41 ha pre-burn and 7.20 ha post-burn for males.

Issues/Concerns affecting the project:

- Due to the severe drought of 2002, and record high rainfalls in 2003, persisting into 2004, we were forced to postpone the Rx fire treatment until fall 2004 on the 3 inland sites (Blackwater NWR, Linkwood WMA). Only one study site at Blackwater (Greenbrier Swamp) was burned on November 9, 2004. The burn was relatively uniform across the entire treatment area, generally 2-3 foot flame lengths, top-killing the majority of sweet pepperbush (*Clethra alnifolia*), killing or top-killing a small proportion of small diameter shrubs such as highbush blueberry, and top-killing a fair amount of greenbrier vines. The two remaining study sites (Kentuck Swamp and Linkwood WMA) could not be burned in fall 2004 due to unfavorable conditions, so these two sites were removed from any further study. We have completed bird, and squirrel mark/recapture data collection at Greenbrier Swamp for 2005. We are currently conducting squirrel telemetry, vegetation, and fuels data collection, which we expect to have completed by mid-September 2005. We expect to complete data analysis and the final written report by the end of December 2005.

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: RISK ASSESSMENT OF FUEL MANAGEMENT PRACTICES
ON HILLSLOPE EROSION PROCESSES PHASE II

JFSP Project No.: 01-3-2-08

Project Location: Moscow, ID; Boise, ID; Riverside, CA

Principal Investigators: P. Robichaud, W. Elliot, F. Pierson, P. Wohlgemuth

Contact Information (Phone, e-mail): 208 883 2349 probichaud@fs.fed.us

Brief Description of Project: Measure erosion parameters in the field and develop needed tools for natural resource managers to predict runoff and soil erosion from wildfires, prescribed fires and fuel management practices.

The erosion risk management tool (ERMiT) will account for temporal and spatial variability of weather, soil conditions, burn severity and site characteristics for postfire assessment.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

An erosion risk management tool, ERMiT, has been developed and the custom interface is targeted for use by hydrologists and soil scientists who are responsible for determining postfire rehabilitation plans. The web-based interface has been used by several postfire rehabilitation teams in 2004 and 2005 fire season (most recently the School Fire, Umatilla NF, WA).

ERMiT's probabilistic approach incorporates variability in climate, soil properties, and spatial burn severity at the hillslope scale. For a given hillslope, the interface will carry out one 100-yr run and twenty 8-16 yr runs, and present the user with tabular and graphical output of the probability of soil erosion exceeding a given amount in each of the first five years following the fire. ERMiT also allows the user to compare the predicted effects of various mitigation treatments (mulches, seeding, barrier treatments such as contour-felled logs or straw wattles) on erosion.

Five WEPP workshops in the last two years have included the ERMiT technology, which has introduced users to the software. To date, 2,300 ERMiT runs have been completed since 2004.

Field work to measure changes in infiltration and erodibility parameters as sites recover has occurred on range and forest lands including the third year at the Hot Creek Fire, Boise NF, ID and Hayman Fire, Pike and San Isabel NF, CO; and the fifth year (2005) in the Valley Fire, Bitterroot NF, MT.

A rangeland prescribed fire was successfully accomplished in 2002 on the Reynolds Creek Experimental Watershed, ID. Small plot rainfall/rill simulations were completed to compare infiltration and erosion with our previously obtained rangeland wildfire erosion rates. These were remeasured in 2003 and 2004.

A physically-based model of the gravity-induced dry ravel erosion process has been developed through a cooperative agreement with Washington State University. This model predicts

source location, sediment movement paths and deposition areas of dry ravel production. Validation of the model output was performed from data collected after the Williams Fire, San Dimas Experimental Forest.

Two of the eight validation paired watersheds that have been established for model validation have been removed in 2005. These two watershed sties were established in 1999 and 2000 and provided 5 years of recovery data in Washington Cascades and California Chaparral.

The deliverables to date: nine papers were published in proceedings and three journal articles were published and fifteen presentations at national meetings and regional workshops. The ERMiT model, currently available at <http://forest.moscowfsl.wsu.edu/fswepp/ermit>, has been updated from measured recovery. Additionally, user feedback has helped us improve the interface.

Issues/Concerns; changes in research objectives, methods, or products:

ERMiT is being validated with independent data from L. MacDonald (see JFSP project 03-2-3-22 for details) and appears reasonable for the smaller events, but may be over predicting for the large events.

Writing the User's documentation and technical journal article is progressing slower than anticipated.

Our infiltration/erodibility field experiments on the Bitterroot and Boise National Forests were completed this summer. These samples are still being processed in the laboratory and data analysis will continue into 2006.

Final project report is due October 1, 2005.

Selected publications:

- Pierson, F.B., K.E. Spaeth, D.H. Carlson. 2002. Impacts o wildfire on soil hydrological properties of a steep sagebrush-steppe rangeland. *International J. Wildland Fire* 11:145-151.
- Robichaud, P.R., R.E. Brown. 2003. Quick response small catchment monitoring techniques for comparing postfire rehabilitation treatment effectiveness. *Proceedings, First Interagency Conference on Research in the Watersheds. Agricultural Research Service. Pp. 663-667.*
- Pierson, F.B., P.R. Robichaud, K.E. Spaeth, C.A. Moffet. 2003. Impacts of fire on hydrology and erosion in steep mountain big sagebush communities. *First Interagency Conference on Research in the Watersheds. Agricultural Research Service. Pp. 625-630.*
- Wohlgemuth, P.M. 2003. Post-fire erosion control research on the Sam Dimas Experimental Forest: past and present. *First Interagency Conference on Research in the Watersheds. Agricultural Research Service. Pp. 645-650.*
- Robichaud, P.R., W.J. Elliot, F.B. Pierson, D. Hall, C.A. Moffet. 2005. Erosion Risk Management Tool (ERMiT), version 2005.04.20, Available online at <http://forest.moscowfsl.wsu.edu/fswepp/ermit>
- Robichaud, P.R. Measurement of postfire hillslope erosion to evaluate and model rehabilitation treatment effectiveness and recovery. *International Journal of Wildalnd Fire*. In press.
- Spigel, K., P.R. Robichaud. First year erosion rates after the 2000 Bitterroot Fires. *Hydrological Process*. In Review.
- Moffet, C.A, F.B. Pierson, P.R. Robichaud, and K.E. Spaeth. Modeling soil erosion on steep sagebrush rangeland before and after prescribed fire. *Catena*. In review.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Identifying Reference Conditions for Prescribed Fire Management of Mixed Conifer Forests in Yosemite National Park, California.

JFSP Project No.: 01-3-3-12

Project Location: Yosemite National Park, California

Principal Investigators: Kara J. Paintner

Dr. Alan H. Taylor

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209-372-0480

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Brief Description of Project: The goal of the project is to identify natural reference conditions for mixed conifer forests from which prescribed fire managers can develop process and structural goals for reintroducing fire to altered forests. The project is designed to fill critical gaps in knowledge needed to develop and implement Yosemite National Park's fire management plan. The specific project objectives are to: 1) quantitatively describe pre-settlement, settlement, and fire suppression period regimes; 2) identify how fire regimes vary along major environmental and forest compositional gradients; and 3) identify pre-fire suppression forest characteristics (basal area, density, size structure) at plot and landscape scales.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): All of the field collection of samples and laboratory processing has been completed for both study areas. Analysis for Study Area 1 is 90% complete, and Study Area 2 is 50% completed. Forest structure and fire history data was collected on a grid for both study areas. Study Area 1 included 88 plots over 22 km², while Study Area 2 included 65 plots over 16 km². Fire history data was derived from 200 samples for Study Area 1, and 148 samples for Study Area 2. Results from the two areas were similar. Key results include:

- Fire scars indicate a predominance of late season burns (33% latewood, 44% dormant).
- The average interval between any sized fire in the study area was the same for both the pre Euro-American settlement and settlement periods (1.6 years) but were longer for the fire exclusion period (8 years). 20th century fires were only recorded on single trees.
- Widespread fires that scarred 25% or more of the samples had an average return interval of 14 years.
- The average point fire return interval was 15 years.
- Fire size ranged from individuals trees to the entire study area
- 70% of the fires were 250 ha or less in size.
- Fire years were significantly associated with drought and north Pacific sea surface temperatures (PDO).
- Forest structure was quantified for 1899 and 2002.
- Forest density increased from an average of 140 trees ha⁻¹ in 1899 to an average of 1000 trees ha⁻¹ in 2002.
- Forest basal area showed little change from an average of 101 m² ha⁻¹ in 1899 to an average of 109 m² ha⁻¹ in 2002.
- There was a compositional shift in species from fire tolerant species in 1899 to fire

intolerant species in 2002.

- Forest age structure was multi-aged suggesting that fires were historically of low or moderate severity.

Deliverables:

- Presentation and discussion of early results were shared with managers for Yosemite National Park at three different times (Yosemite Fire Management Office, Yosemite Prescribed Fire Office, and Yosemite Forum Speaker Series).
- Early results were shared with Yosemite Prescribed Fire Staff and considered in developing the Draft Fire Management Plan for the park.
- Presentations of papers were given at four professional meetings.
- Visualizations of both the historic and contemporary forest structure were developed to help understand the magnitude of forest changes that have occurred since fire exclusion.
- One Masters Thesis in Geography at Penn State (Guarin, A. 2003. The influence of climate and topography on forest dieback in mixed conifer forests, Yosemite National Park, California, USA) was completed.
- One Phd Dissertation in Geography at Penn State (Scholl, A., Fire regimes and forest changes in mixed conifer forests in Yosemite National Park: Processes and patterns at multiple scales) is in progress (completion 2006).
- One paper (Guarin & Taylor 2005. Drought triggered tree mortality in mixed conifer forests in Yosemite National Park, California, USA.) was published.
- Three papers on forest structure and fire regimes, fire climate relations, and carbon sequestration resulting from fire suppression are in progress.

Issues/Concerns; changes in research objectives, methods, or products:

A One year no cost extension was requested and approved to complete the project.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire and Forest Structure Across Vegetation Gradients in San Juan National Forest, Colorado: A Multi-scaled Historical Analysis

JFSP Project No.: 01-3-3-13

Project Location: San Juan National Forest, Colorado

Principal Investigators: Peter M. Brown (Rocky Mountain Tree-Ring Research) and Rosalind Wu (San Juan National Forest)

Contact Information (Phone, e-mail): Brown: 970.229.9557, pmb@rmtrr.org; Wu: 970.385.1389, rwu@fs.fed.us

Brief Description of Project: We are using tree-ring data to document and analyze fire regimes (frequency, severity, seasonality, and extent) and fire timing, tree establishment, and climate relationships across forest gradients in the Piedra River drainage of SW Colorado. We have used a gridded plot design to compare and contrast fire and stand histories across ponderosa pine, mixed-conifer, and subalpine forests. Methods and results from the study have applicability to both on-going and proposed restoration and fuels treatment programs by providing baseline data on historical patterns and current fuel and forest conditions associated with fire suppression and land use over the past century.

Status Report:

- We completed all field sampling across three physiographic and vegetation landscapes.
- We collected tree-ring samples and stand and tree data from ~3,700 trees in 122 plots. We have analyzed ~90% of them, the rest to be completed by the end of Sept, 2005.
- We established a project web site: <http://www.rmtrr.org/SJNF/SJNFfirehistory.html>.
- We completed analysis at one of the landscapes on Archuleta Mesa, and these data are summarized in a paper in press: P.M. Brown and R. Wu, 2005, Climate and disturbance forcing of episodic tree recruitment in a southwestern ponderosa pine landscape, *Ecology*.
- Professional presentations of project data include: 11/2003, 2nd International Wildland Fire Ecology and Fire Management Congress, Orlando, FL (*Reconstructing spatiotemporal patterns in fire regimes from fire-scar and tree-origin data in southwestern ponderosa pine forests*); 5/2004, Mountain Climate Science Symposium, Lake Tahoe, CA (*Between drought and fire: Climatic and disturbance forcing of episodic tree recruitment in ponderosa pine forests*); 11/2004, Mixed Severity Fire Regimes: Ecology and Management, Spokane WA (*Defining scales: time, place, and bottom-up effects on fire regimes*); 12/2004, American Geophysical Union Annual Meeting, San Francisco, CA (*Fire and climate: Past, present (and future?)*); 2/2005, Region 2 Ecologists and Botanists Meeting, Ft. Collins, CO (*HRV data from tree rings: Methods and issues*); 4/2005, American Association of Geographers Annual Meeting, Denver, CO (*Spatial and temporal variation in importance of antecedent and fire year climate for fire occurrence*); 5/2005, Ecology and Management of Pinyon-Juniper and Sagebrush Communities Conference, Montrose, CO (*Fire history studies in the Rocky Mountains*).
- Results are being used in a SJNF NEPA assessment for fire use in the Piedra area.

This coming fall, 2005, we will begin drafting additional manuscripts for peer-reviewed journals and make additional oral presentations to managers and planners across the study area and throughout Region 2.

Issues/Concerns; changes in research objectives, methods, or products: We requested a 9-month extension from JFSP for final project completion from September 30, 2005 to June 30, 2006. We had originally planned the three field seasons called for in the proposal would start in summer, 2001, but the cooperative agreement between San Juan National Forest and Rocky Mountain Tree-Ring Research that forms the funding instrument for the project was not in place until May, 2002. We completed three field seasons in 2002, 2003, and 2004, during which we collected a data set of over 3700 trees. We requested the project extension since we plan further analyses of the data, papers to submit, and presentations to managers this coming fall, 2005, and winter, 2006. A final report at the end of September would not include all results and deliverables from the project.

JFSP 2005 Principal Investigator Workshop

Project Title: Jeffrey Pine-Mixed Conifer Fire History and Forest Structure With and Without Fire Suppression and Harvesting

JFSP Project No.: 01-3-3-27

Project Location: Sierraville RD, Tahoe NF – Bridgeport RD, Humboldt-Toiyabe NF

Principal Investigators: C. Skinner, S. Stephens, S. Wilbanks

Contact Information: Phone 530-226-2554, e-mail cskinner@fs.fed.us

Description of Project: There is currently debate on appropriate target conditions for fire hazard reduction and forest restoration. This is due to the lack of unmanaged forests that could serve as references in the western US. The pine-dominated, mixed-conifer forests of the Sierra San Pedro Martir (SSPM), Mexico, have not experienced logging and systematic fire suppression. The SSPM is unique within the California floristic province in that its forests are still regularly influenced by fires similar to those that once occurred throughout the western United States. The mixed conifer forests of the SSPM may provide information on reference conditions for similar forests that prehistorically experienced frequent, low to moderate intensity fires. This information could be used to help develop target stand conditions for reducing the fire hazard in large portions of California and Nevada mixed conifer forests. The objectives of this project are to compare climate, fire history, and stand structures of coniferous forests of the Sierra San Pedro Martir with similar forests of the Sierra Nevada.

(This grant funds the work in the eastern Sierra Nevada, California; matching funds are used for the work in the SSPM).

Status Report:

Data analysis has been completed. Working on completing the final report.

Issues/Concerns affecting the project: None. Working on the final report.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: : Predicting the invasion and survival of the exotic species *Paulownia tomentosa* following burning in pine and oak-pine forests

JFSP Project No.: 01-3-3-33

Project Location: Great Smoky Mountain National Park and surrounding USDA Forest Service properties

Principal Investigators: A. Jenkins¹, Peter S. White², and Dane M. Kuppinger³

Contact Information (Phone, e-mail): (865) 430-4742¹, mike_jenkins@nps.gov¹, (919) 962-6939², pswhite@unc.edu², (919) 962-6934³, kupp@email.unc.edu³

Brief Description of Project: In the last decade, it has become increasingly clear to land managers that fire is an important component of many forest habitats here in the southern Appalachians and there has been a corresponding increase in the use of prescribed fires to mimic natural fire regimes. However, exotic species that invade after fire have become a management concern in natural areas. *Paulownia tomentosa* has a reputation for invading natural areas following disturbance and has been observed to significantly increase in frequency following some fires. This project is designed to assess the site and stand level biotic and abiotic conditions related to fire and the underlying environment that enables the successful invasion and survival of *Paulownia*. The relationship between these variables will be assessed through field surveys undertaken following burns and subsequent experiments designed to test the correlations observed in the field and look for potential interactions between variables.

It is hoped that this investigation will increase managers' ability to predict the areas in which *Paulownia* is most likely to invade so that monitoring and control efforts can be appropriately focused.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- We were granted a no-cost extension to rerun unsuccessful experiments.
- We are currently rerunning experiments after corrective measures that we hope will insure their success.
- All fieldwork is completed and analyses of field data are underway.
- We presented preliminary results at the Association of Southeastern Biologists fall meeting in 2004.
- Initial results suggest that a combination of landscape and watershed-scale factors influence *Paulownia* invasion.

Issues/Concerns; changes in research objectives, methods, or products:

We are re-conducting the experiments in Chapel Hill where we will be able to visit the site more regularly. We hope that closer monitoring of soil moisture and other conditions will insure that a sufficient number of seeds germinate to permit treatments.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: The Flomaton Natural Area: Demonstrating the benefits of fuel management and the risks of fire exclusion in an old-growth longleaf pine ecosystem

JFSP Project No.: 01B-3-1-01

Project Location: Flomaton, Alabama

Principal Investigators: John S. Kush, Ralph S. Meldahl, and Charles K. McMahon

Contact Information (Phone, e-mail): (334) 844-1065, kushjoh@auburn.edu

Brief Description of Project: The impacts of ecological restoration on longleaf pine forests are being studied in the Flomaton Natural Area (FNA) in Escambia County, Alabama. The FNA is a 25-hectare virgin longleaf pine stand that was protected from fire for >45 years. The re-introduction of fire posed a problem because fuel accumulations increased the possibility of burn conditions that can be lethal even to the larger trees that are normally very fire resistant. The absence of fire for 45 years allowed feeder roots to colonize the duff layer near the surface and thus be exposed to the heat of the slow moving surface fire and any subsequent residual smoldering combustion. Fires that consume this layer will damage root systems and result in the death of overstory trees even if the fire is of low intensity and produces little to no visible crown scorch. In an effort to minimize this potential damage with the re-introduction of fire, prescriptions were prepared which called for exacting fuel moisture and meteorological conditions, the sequential application of fire to portions of the site, and the extensive mop-up and watering of duff layers near the base of mature trees. Restoration planning of the FNA using prescribed fire began in 1993. The first prescribed fire was conducted in 1995. Subsequent prescribed burns were conducted in 1996, 1997 and 2001. The JFSP demonstration project objectives are: to develop a demonstration site on the Flomaton Natural Area; to conduct post fire environmental monitoring of overstory mortality, litter depth, understory plant and animal communities, and soil nutrients; to construct an interpretative trail with supporting educational materials for use on site; and to develop an educational guide book for use in the schools of the local community.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

The initial longleaf pine density and basal area were 256 trees/acre and 78.8 ft²/acre. By 2004, there were 91 trees/acre with a basal area of 74.9 ft²/acre. The restoration effort with the use of fire was responsible for 10.2 percent of the mortality. Prior to the reintroduction of fire, there were an average of 2.92, 4.79, and 8.03 tons/acre of litter, partially decomposed litter and humus in the stand, respectively. By 2003 it was 1.37, 5.15, and 5.67 tons/acre. Three publications were produced in 2004-2005 from this project:

Kush, J.S., R.S. Meldahl, and C. Avery. 2004. A regeneration success: Longleaf pine seedlings established in a fire suppressed old-growth stand. *Ecological Restoration*. 22(1):6-10.

Kush, J.S., and R.S. Meldahl. 2006. Stand dynamics of a longleaf pine restoration project. *In: Proceedings of Thirteenth Biennial Southern Silvicultural Conference*, February 28-March 4, 2005, Memphis, TN. USDA Forest Service GTR-SRS (In press).

Kush, J.S. and R.S. Meldahl. 2004. Restoring fire and fuel management in an old-growth longleaf pine ecosystem: a success? Abstracts of the 89th Annual Ecological Society of America Meeting; August 2-6, 2004; Portland, OR. p. 284.

On September 16, 2004 Hurricane Ivan passed to the west of the FNA. Approximately 40% of the stand was laid down by winds in excess of 110 miles per hour.

Issues/Concerns; changes in research objectives, methods, or products: None at this time.

JFSP 2005 Principal Investigator Workshop

Project Title: Dormant-Season Prescription Fires to Reduce Hazardous Fuel Loads on the South Carolina Coastal Plain: Establishing a Demonstration Area on a 40+ year Study

JFSP Project No.: 01B-3-1-03

Project Location: Francis Marion National Forest, South Carolina

Principal Investigators: Kenneth W. Outcalt, USDA Forest Service, SRS.

Contact Information (Phone, e-mail): (706) 559-4309 koutcalt@fs.fed.us

Description of Project:

A demonstration area at Francis Marion National Forest to achieve the following goals:

- 1) To influence public opinion about the benefits of frequent low intensity prescription fire versus fire exclusion through the dramatic visual story told by this study, and to make this research site more user friendly by placing signs on all plots, erecting a display board, and directing interested people to literature and a web site pertaining to this study.
- 2) To speed up summarization and publication of the 42-year database to document the changes in vegetative structure and composition, and to provide better "hard" fire behavior and fuel consumption numbers urgently needed in fire management planning as inputs into various models

Status Report: Since the announcement of the successful funding of the project, Dale Wade met with National Forest personnel and formed an oversight committee to guide the development, content and placement of signage. Signs were constructed and erected in the corner of each treatment plot showing plot number and treatment received. The website was completed and launched in January 2004. The poster for the display board has been completed and will be mounted next month when the display is completed. A complete vegetation survey was conducted on all plots during 2003 and 2004. This data has been analyzed and will be included on the web site and display board.

Significant progress has been made on Objective 2. Using the information from the forty-two year database, an article in a peer reviewed journal has just been published (Glitzenstein, J.S., D.R. Streng and D.D. Wade. 2003. Fire frequency effects on longleaf pine (*Pinus palustris* P. Miller) vegetation in South Carolina and northeast Florida, USA. *Natural Areas Journal* 23:22-37). Data analysis is ongoing. A tour of the plots was given to scientists from Southern Research Station in 2005. A workshop tour was also conducted for scientists and land managers in November 2004. Result from the study were included in an oral presentation at International meeting on conversion of forest in Friburg, Germany in 2003 and an oral presentation was made at Fire Science Workshop in Charleston, SC in 2004. Results were presented in poster at Ecological Society of America meeting in August 2005 in Montreal.

Major Findings:

- Grasses increased with more frequent burning, covering annually burned areas and much of the biennially burned plots.
- Species richness increased on all burned areas but was highest with 1 or 2 year fire return intervals.
- A two-year cycle favored longleaf pine regeneration while loblolly pine seedlings were more prevalent with longer fire frequencies.
- Thus, composition of the understory and the eventual overstory can be directed by choosing the appropriate fire frequency.

Issues/Concerns affecting the project: Project was delayed by 1 year due to 2002 wildfires.

JFSP 2005 Principal Investigator Workshop

Project Title: Long-term Dormant-Season Burning Interval Study in the Palmetto/Gallberry Fuel Complex: Establishing an Adjacent Growing-Season Burn Study and Making Both Demonstration Areas

JFSP Project No.: 01B-3-1-04.

Project Location: Osceola National Forest, Olustee, FL

Principal Investigators: Kenneth W. Outcalt

Contact Information (Phone, e-mail): 706-559-4309, koutcalt@fs.fed.us

Description of Project: In 1958 the Forest Service Research Station installed a hazardous fuel reduction study in a longleaf pine (*Pinus palustris*) stand with a southern rough (saw palmetto [*Serenoa repens*] / gallberry [*Ilex glabra*]) understory on the Osceola National Forest. Since this time, plots have been regularly burned at 1, 2, and 4-year intervals during the dormant season. This purpose of this project was to establish a demonstration area using these plots and plots in an adjacent area that would be burned during the growing season. The objective was to influence public opinion about regular prescribed burning through the dramatic visual story of the plots and to make the site more user friendly. The addition of the growing season plots, will also allow comparison of fuels and vegetation using the two major burn seasons for this region.

Status Report: Since the announcement of the successful funding of the project, Kenneth Outcalt met with National Forest personnel and formed an oversight committee to guide the development, content and placement of signage. The web site portion of objective 1 was accomplished and the site has been up since July 2002 (www.srs.fs.fed.us/osceola). All plots were signed in 2003. A poster for the display board has been created and reviewed. This will be printed and put on site in September. The summer burn plots of objective 2 were installed and all pre-burn treatment data collected in June 2002. Plots were scheduled to be burned but when weather became suitable, all personnel and funds were redirected to controlling western wildfires. We re-scheduled the annual summer burns, which occurred 2003. The following year, 2004 we burned all but the control plots for both the summer and winter portion of the study. All scheduled plots in both dormant and growing season areas were successfully burned again in 2005. Two field tours of the plots to educate others have been conducted. The first for students from University of Florida in 2002 and the second for National Forest managers in April 2005. Poster presentations summarizing results have been made at Society for Ecological Restoration in 2003 and at Ecological Society of America in 2004.

Major findings:

- Understory composition was most different on the annually burned plots.
- To materially change the composition it seems to take a number of annual dormant season burns.
- There is some indication that growing season burns are more effective, but it will still require a number of burns to reduce palmetto dominance because it is so resistant to fire.

Issues/Concerns affecting the project: The purchasing freeze and funding redirection due to western wildfires in 2002 did delay complete implementation of the demonstration area. Because of this we requested and received a 1 year no cost extension to finish the project.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Management of Fuel Loading in the Shrub-steppe

JFSP Project No.: 01B-3-2-07

Project Location: Columbia and Saddle Mountain National Wildlife Refuges, Washington

Principal Investigators: Dr. Steven O. Link, Randal W. Hill, Eric Hagen

Contact Information (Phone, e-mail): 509-948-0054, slink@tricity.wsu.edu

Brief Description of Project: The objective was to develop a management strategy to reduce fuel loading and fire risk in the shrub-steppe. We looked for the minimum amount of herbicide needed to reduce cover of alien species (*Bromus tectorum*, *Sisymbrium altissimum*) to allow establishment of a competitive bunchgrass without damaging the native flora. We investigated the effect of two herbicides, their concentrations, repeated herbicide application, fire, and seeding on fuel loads and ecological restoration. We also investigated the relationship among community types (fuel loading), wind, and the probability of a carrying fire. Experiments were conducted in the semi-arid shrub-steppe of southcentral Washington.

Status Report:

- Planned and accomplished science delivery and application efforts.
- 1) What is the minimum concentration of herbicides that will shift the competitive balance to native species (vascular plants and soil cryptogams) and away from *Bromus tectorum* (cheatgrass) that will result in less continuous fuel loading? Four oz/acre (0.28 kg ha^{-1}) of imazapic applied after a prescribed burn in the fall. Native plant species diversity increased with increasing imazapic concentration in the second year after application.
- 2) What is the effect of repeated herbicide application on the competitive balance between native species and *B. tectorum*? Repeated application of glyphosate increased native species cover from about 20% in 2002 to about 45% in 2004 while reducing alien cover from about 60% in 2002 to about 25% in 2004 at concentrations above 0.07 kg ha^{-1} .
- 3) What is the effect of a prescribed burn on the competitive balance between native species and *B. tectorum*? *Bromus tectorum* cover was reduced from 52 to 38% in 2003 with no change in native species cover. The effect of the fire on *B. tectorum* cover was gone in 2004.
- 4) What is the effect of seeding *P. secunda* into treatment areas on the competitive balance between native species and *B. tectorum*? We seeded the large bunchgrass, *Elymus wawawaiensis*, as had been done in an adjacent field in Oct. 1986 after a fire. In 2004, after 18 years, native plant cover was 68.2% while *B. tectorum* cover was only 2.8%. In our control plots, native plant cover was 41%, and *B. tectorum* cover was 24% in 2004. It is too early to detect the effect of seeded bunchgrasses on the competitive balance in treatment areas.
- 5) What is the relationship between plant communities with varying degrees of *B. tectorum* cover, wind, and the probability that fire will be sustained? In a *Poa secunda*-*Bromus tectorum* community, fire risk is 46% with 12% *B. tectorum* cover rising to about 100% at 44% cover. There was no effect of wind speed less than 10 mph on fire risk. In a restored *E. wawawaiensis*-*P. secunda* community with 2.8% *B. tectorum* cover risk was 66%. In two, 7 year-old restorations with large bunchgrasses, fire risk was 78% and with 18.5% and 5.6% *B. tectorum* cover, respectively. Reducing continuous fuel loading and increasing open spaces (bare soil and soil cryptogams) reduces fire risk.
- Deliverables: 1 symposium proceedings published; 1 book chapter in press, 1 journal (IJWF) accepted; 2 journal articles ready for submission in IJWF; 2 journal articles in preparation, 2

newsletter articles, 4 newspaper articles, 9 abstracts, 2 organized workshops, 11 invited presentations, and one webpage. One management document in preparation.

- Management implications: Management now knows the minimum concentration of imazapic that allows establishment of competitive bunchgrasses without damaging native plant species. Investigations with glyphosate helps management understand the consequences if its use compared with imazapic. The strong effect of imazapic on alien annual mustards (*Sisymbrium altissimum*) helps management determine its use in areas where rare native mustards are found and for control of *S. altissimum*. An understanding of fire risk in areas with *B. tectorum* infestations helps management prioritize areas for fuel reduction. Knowledge of the reduction in fire risk in restored communities helps management assess the effects of their efforts in fuel load reduction.

Issues/Concerns; changes in research objectives, methods, or products:

- Seeded *Elymus wawawaiensis* instead of *Poa secunda*.
- Wind (<10 mph) was not a factor in the fire risk experiment, thus fire risk in restored communities was determined.
- Effects of drill-seeded bunchgrass on *B. tectorum* cover and fuel reduction needs longer monitoring.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of Fire and Rehabilitation Seeding on Sage Grouse Habitat in Pinyon-Juniper

JFSP Project No.: 01B-3-3-01

Project Location: Nevada

Principal Investigators: Jeanne Chambers, Robert Blank, Robin Tausch, Erica Fleishman

Contact Information (Phone, e-mail): J. Chambers (775) 784-5329 (jchambers@fs.fed.us)

Brief Description of Project: A JFSP Demonstration Area was established in central Nevada in 2001 to examine the response of pinyon-juniper woodlands to prescribed fire over typical tree density and elevational gradients. This project focuses on the Demonstration Area and is examining: (1) effects of fire on soil characteristics/stability and vegetation composition and production of associated sagebrush communities; (2) effects of rehabilitation seeding with introduced and native species on soils and vegetation; (3) effects of fire on plant establishment and nutritional characteristics of species used by sage grouse; and (4) the presence, abundance and location of sagebrush obligate bird species over the tree density and elevational gradient and the effects of fire on those species. Research scale burns were completed in spring 2002; watershed scale burns were completed in 2004.

Status Report (include planned and accomplished science delivery and application deliverables, and management implications of your research- summarize information with bullet statements):

- Research examining soil infiltration before and after the spring burns indicate infiltration decreased with increasing elevation due to decreased coarse fragments, and that burn effects occurred primarily under trees at the mid-elevation site and were short-lived (about one-year). Coarse soils limit erosion on the sites. (2003 SSSA meeting; MS Thesis, 2005 JRM manuscript)
- Research evaluating the soil chemical response to spring burns showed immediate increases in ammonium; nitrate increased that fall. Ortho-phosphate increased to depths of -52 cm for over a year. Micro-nutrients ZN and MN also increased. The nutrient increases may make these sites susceptible to invasive plants. (2004 SSSA meeting, MS Thesis, SSSA manuscript *submitted*)
- Research on nutrient contents of plants used by sage grouse indicated differences existed among sites and species that were not related to treatment, and that the nutritional content of certain species increased following fire. (Manuscript *in progress*; MS Thesis).
- Preliminary vegetation data indicates that higher elevation plots had greater increases in herbaceous cover and biomass than lower elevation plots after the burn. Low and intermediate tree cover plots had significantly greater herbaceous cover and biomass than high cover plots before and after the burn indicating a threshold of recovery. (2004 ESA Meeting; MS thesis *in progress*)
- Ant species composition differed among elevations and ant population abundances increased with increasing elevation. Fire had little immediate effect on ant species abundances, but populations may change as the different species adjust to new food resources. (2004 ESA Meeting; 2005 MS Thesis, Manuscript *in progress*)
- Research on responses of breeding birds to vegetation structure, composition, and productivity in burned and control sites indicated that spatial patterns of avian composition and vegetation composition were similar. Many species use resources in both burned and control sites. (13 manuscripts published, 2 submitted, 2 MS theses, 6 invited presentations, 3 contributed presentations)
- Yearly field tours of the research projects are attended by agency personnel, Yomba-Shoshone tribal members, university faculty and students, local citizens, and congressional representatives.

Issues/Concerns; changes in research objectives, methods, or products: The watershed scale burns were delayed limiting interpretation of the bird data. A third project has been initiated on response of birds, butterflies, and their habitats to management of wildland fuels and fire regimes.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: The effect of season and interval of prescribed burns in a ponderosa pine ecosystem.

JFSP Project No.: Project Number 01b-3-3-16

Project Location: Burns, Harney County, Oregon (Malheur National Forest)

Principal Investigators: Walter G. Thies, Christine G. Niwa, Becky K. Kerns

Contact Information (Phone, e-mail): 541-750-7408; wthies@fs.fed.us

Brief Description of Project: The project superimposes two burn intervals on an existing season of burn study. The existing seasonality of prescribed burn study was established in ponderosa pine type in the south end of the Blue Mountains in southeastern Oregon. Three treatments (no burn, fall 1997 burn and spring 1998 burn) were assigned randomly to three 30-60 acre experimental units in each of six replicates (stands). The initial study was installed to determine if season of burn influenced the incidence of black stain root disease (BSRD)-caused mortality of ponderosa pine. This project expanded the study to examine understory vegetation, bark beetle-caused tree mortality and an evaluation of first order fire effects. The experimental design, completed prescribed burn, established monitoring plots, and existing data on a range of factors, offered a unique opportunity. This JFSP project proposed to bisect each experimental unit and randomly select one subunit of each pair to be burned 5 years following the initial burn while the second subunit would be used to test a longer interval of burn. The season of burn for each subunit would remain the same as in the established study. This resulted in two additional treatments (burned falls 1997 and 2002, and burned springs 1998 and 2003) on each of the six replicates. Results from this study will provide managers knowledge to evaluate two of the most basic variables of wildland fuel management, season and interval of burn.

Status Report: The 5-year-burn was conducted and all proposed field activities and data collections have been accomplished. Data from this project is reported in two papers that have been accepted, two more now submitted and several more planned; three presentations to user groups have been planned. **Accepted papers:** a) Thies, W.G., Westlind, D.J., and Loewen, M. 2005 (in press) Season of prescribed burn in ponderosa pine forests in eastern Oregon: impact on pine mortality. Int. J. Wildland Fire 14:xx b) Kerns, B.K., Thies, W.G., and Niwa, C. 2006 (in press) Season and severity of prescribed burn in ponderosa pine forests: implications for understory native and exotic plants. Ecoscience 13(2):xx. **Management Implications:** a) The percentage of ponderosa pine mortality was higher after fall prescribed burns than after those in spring. b) Season of prescribed burn had an effect on survival of ponderosa pine as it influenced fire intensity and burn severity. c) BSRD-caused mortality is not influenced by season of burn. d) Lion's tail, a purported symptom of BSRD, was not a reliable predictor of BSRD incidence. e) There were significantly more exotic and native short-lived ruderal species in areas where prescribed fires were done in the fall compared to areas that were burned in the spring or were left unburned. These differences were largely attributed to indirect fire effects associated with burn severity rather than direct effects related to season of burn and plant growth status.

Issues/Concerns; changes in research objectives, methods, or products: None

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Integrating prescribed fire into management of mixed-oak forests of the mid-atlantic region: Developing basic fire behavior and fuels information for the SILVAH system

JFSP Project No.: 01B – 3 – 3 - 15

Project Location: Connecticut, New Jersey, Pennsylvania, & West Virginia

Principal Investigators: Patrick Brose, Thomas Schuler, & Jeffrey Ward

Contact Information (Phone, e-mail): (Brose) 814-563-1040, pbrose@fs.fed.us

Brief Description of Project:

The near elimination of the natural fire regime of mixed-oak forests of the Mid-Atlantic region has led to several undesirable changes. One of these is the inability of oaks to regenerate on their own. Managers are increasingly interested in using prescribed fire to create conditions that will sustain mixed-oak forests but there is a lack of knowledge about fire behavior and fire effects in these ecosystems. Scientists are evaluating the applicability of existing hardwood fuel models to a wide variety of fuel conditions in mixed-oak forests. A photo-series illustrating fuel conditions not well represented by existing fuel models is also being developed. Prescribed fire planning and implementation in these forests will become more effective and safer with this information.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

1. Project got off to a slow start due to several reasons including two years of excessively wet weather (2003 and 2004) that prevented almost all prescribed burning in the mid-Atlantic region. Fuels and fire behavior were evaluated in five prescribed burns but results were inconclusive because weather conditions were largely unsuitable.
2. Due to the uncooperative weather, the project was extended through 2005.
3. Fire weather conditions improved dramatically in fall 2004 and spring 2005, allowing 10 prescribed burns to be evaluated for fuels and fire behavior. Ten more prescribed burns are slated for this fall and spring 2006 and these will also be evaluated even though they are after the project's deadline.
4. Preliminary analysis of the data indicate that fuel model 9 is a reasonable representation of oak leaf litter regardless of season, fuel model 8 is appropriate only for northern hardwood leaf litter, and none of the fuel models are adequate for the ericaceous shrubs.
5. Work continues on the photo series. Thirty plots in ericaceous shrubs and logging slash were established and photos taken during the growing season. Dormant-season photos are to be done this fall.
6. Preliminary data from two of the prescribed burns in Connecticut were presented by Jeff Ward at the 2004 Central Hardwoods Conference. Preliminary data from two of the Pennsylvania fires were presented at the 2005 National Silviculture Workshop. Several peer-reviewed and conference proceedings publications are anticipated once all the data are collected and analyzed.

7. The research project has been covered by local newspapers. The Hartford (CT) Courant published a story on the fire research in that state with several quotes from Jeff Ward. The Newark (NJ) Post sent reporters to cover the research burns conducted in New Jersey and interview Patrick Brose about the project.
8. All of the five sites burned in 2002 and 2003 have been incorporated into forestry field tours and training sessions by researchers and local foresters. Each burn site has been used several times in this regard. Sally Collins (Associate Chief of the USDA Forest Service) toured one of the burn sites in fall 2003 while visiting RWU-4152. The burns done in fall 2004 and spring 2005 will be used for upcoming forestry tours and training such as the 2006 SAF National Convention.

Issues/Concerns; changes in research objectives, methods, or products:

No significant changes have occurred to the study design or the methodology. Anticipated products are unchanged but delivery has been pushed back due to the numerous delays, especially the wet weather.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: An Evaluation of Fire and Fire Surrogate Treatments within a Chaparral Plant Community

JFSP Project No.: 01B-3-3-27

Project Location: Whiskeytown National Recreation Area, California

Principal Investigators: Tim Bradley and Jennifer Gibson

Contact Information (Phone, e-mail): (530) 242-3456 Tim_Bradley@nps.gov ,
(530) 242-3457 Jennifer_Gibson@nps.gov

Brief Description of Project:

This project involves the establishment and analysis of seven different fuels treatment methods in chaparral, mixed oak woodland, and knobcone pine forest vegetation. The focus of this project is on the comparison between mastication, mastication with burning during both spring and fall seasons, burning without mastication, hand-thinning and a control (no treatment). Mastication and hand-thinning treatments occurred during the fall of 2002. Burning occurred during the spring of 2003 and fall 2004. Data collected over time include such variables as total vegetation cover by species, frequency of species, vegetation structure, fire behavior indices, fire severity and soil impacts. An additional study parameter includes an assessment of the soil seedbank along a distance gradient from past disturbances within the general study site.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Updated project website, including posting of fire severity and preliminary vegetation response findings
- Organized and led two on-site university field visits and one interagency field trip.
- Directed site orientations for two newly funded JFSP projects that will conduct complimentary studies within our study site
- Presentation of preliminary findings at multiple in-park meetings has altered proposed fire management activities.

Issues/Concerns; changes in research objectives, methods, or products:

While our focus is on short-term response, it has become clear that vegetation response changes significantly through time. Of particular concern is the initial establishment and expansion of early seral species, many of which are exotics, and how these species persist or disappear through time. Observations indicate that homogeneous responses for wind dispersed species do not usually occur across the landscape but rather occur in patterns that are influenced by seed source proximity, wind, or other factors that deserve greater study. Because long term vegetation development is a primary concern, park staff expect to continue measuring vegetation over the next several years despite the termination of support funding from the JFSP.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire Effects on Rare Flora and Fauna in Southern California National Forests

JFSP Project No.: 01B-3-3-28

Project Location: Riverside Fire Lab and various burned areas in coastal southern California

Principal Investigators: Jan L. Beyers and Marcia G. Narog

Contact Information (Phone, e-mail): JB: 951-680-1527, jbeyers@fs.fed.us; MN: 951-680-1548, mnarog@fs.fed.us

Brief Description of Project:

The four southern California national forests (Angeles, Cleveland, Los Padres, and San Bernardino) and adjoining areas are home to over 70 federal and state listed threatened and endangered plant and animal species. The Forest Service lists another 169 species in these national forests as Sensitive, and many more are on Watch lists. While fire is a natural habitat component for most of these species, little is known about the type of fire regime to which they are adapted. At the same time, prescribed fire and other fuel treatments are increasingly being applied in these areas. We are working to compile information about potential fire responses of these species via review of scientific literature, field surveys after wildfires and prescribed fires, and experiments. Information gathered will provide additional data for the national Fire Effects Information System (FEIS) database that land managers use in planning fuels treatment projects.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research – summarize information with bullet statements):

- An additional year of field data on several burn area projects was collected.
- Despite near-record rainfall in winter 2004-2005 and evident flooding in riparian areas, a FS-sensitive fish species survived and was detected during surveys in Cajon Creek (burned 2002). Three federally-listed species were recorded at the burn site as well.
- Recovery of FS-sensitive plant species was documented at several burn sites (wildfire and experimental burns).
- Analyses of field data from this project were presented at annual meetings of:
 - the Ecological Society of America (2004 and 2005),
 - Western Section-The Wildlife Society, and
 - Southern California Academy of Sciences.
- A project staff member attended training on the Fire Effects Information System so we could better tailor our products to the needs of the database manager.
- Species write-ups are being completed in 2005-2006 (extension granted; see below).

Issues/Concerns; changes in research objectives, methods, or products:

We have requested and received a one year no-cost extension for this project. The technician supposedly dedicated to this project had to help with other field work (delaying work on this project) and is now on maternity leave. No other staff are available to help until she returns.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: An integrated assessment of the historical role and contemporary uses of prescribed fire in southern Appalachian ecosystems

JFSP Project No.: 01C-3-301

Project Location: Coweeta Hydrologic Laboratory, Southern Research Station, USFS, Otto, NC – western North Carolina

Principal Investigators: Drs. James M. Vose, Katherine J. Elliott, Theodore L. Gragson, and W. Wallace Covington

Contact Information (Phone, e-mail): 828-524-2128; jvose@fs.fed.us

Brief Description of Project: The project objectives were to: 1) document and synthesize information on the historical and contemporary southern Appalachian fire regimes; and 2) evaluate the effects of prescribed fire on ecosystem structure and function along a moisture/productivity gradient from xeric, pine-hardwood to mesic, mixed-hardwood ecosystems in the southern Appalachian region.

Two of the three prescribed burn projects are ongoing (a xeric, pitch pine-hardwood and a dry, shortleaf pine-hardwood) and measurements are being continued to evaluate long-term ecosystem responses. The third project was added to understand and compare effects of fire on mesic, mixed-hardwood ecosystems in the southern Appalachians where information is lacking.

Status Report: We have made considerable progress on our project, which is in its third year of the 3-year funding cycle. The two graduate students, under supervision of the university co-PIs (University of Georgia and Northern Arizona University) have completed their studies related to this project. The NAU student (Ms. Nikki Cooley) has completed interviews with tribal elders of the Eastern Band of the Cherokee Nation; transcription of the interviews is complete; and a MS thesis was completed May, 2004. The UGA graduate student (Mr. William Jurgelski) has completed the collection of archived information from early 1990's USFS and NC State Forest Service records to synthesize information for the contemporary fire regimes; a manuscript for publication is nearly complete.

To evaluate the effects of prescribed fire on mesic, mixed-hardwood forests, three sites were located (one in north Georgia and two in western North Carolina). Permanent plots were established and pre-burn and post-burn measurements (vegetation, soil and soil solution chemistry, carbon and nutrient pools, stream chemistry and sediments) have been collected on all three sites. Two sites were burned in Feb-March 2004; one by the Tallulah Falls Ranger District, Chattahoochee National Forest (north GA) and one by the Wayah Ranger District, Nantahala National Forest (western NC). The third site in the Wine Spring watershed (western NC) was burned in March, 2003 by the Wayah Ranger District; post-treatment data have been collected for the first and second growing seasons after the fire, 2004-2005. Information from the ongoing projects has resulted in 3 refereed papers, 3 proceedings papers, and 1 thesis; 10 presentations; a Fire Ecology workshop hosted and organized by Coweeta Hydrologic Laboratory; and 4 other technology transfer efforts to National Forest Managers and the Eastern Band of the Cherokee Nation (see attached below).

Issues/Concerns affecting the project: No concerns at this time.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Short-Term Effects of Fire and Fire Surrogate Treatments on Fisher Habitat in the Sierra Nevada

JFSP Project No.: 01C-3-3-02

Project Location: Blodgett Forest Research Station and Sequoia-Kings Canyon National Park, California

Principal Investigators: Richard L Truex and William J. Zielinski

Contact Information (Phone, e-mail):

RLT: (559) 784-1500 x. 1171, rtruex@fs.fed.us

WJZ: (707) 825-2959, bzielinski@fs.fed.us

Brief Description of Project:

We examined the short-term effects of Fire and Fire Surrogate (FFS) treatments on fisher (*Martes pennanti*) habitat at 2 FFS sites in California's Sierra Nevada from 2001 – 2004. The fisher has recently experienced considerable range reduction throughout the Sierra Nevada and appears to require certain habitat elements associated with mature forest conditions (e.g., dense canopy, large trees). Potential resource conflicts exist between maintaining habitat to support viable fisher populations in the Sierra Nevada and meeting fuels reduction and vegetation management projects needed to protect mountain communities and reduce the likelihood of large-scale catastrophic fires.

Blodgett Forest Research Station (BFRS) was the primary FFS site in the Sierra Nevada, and compared the effects of mechanical, prescribed fire, and mechanical followed by prescribed fire on various resources. The second FFS site was located at Sequoia-Kings Canyon National Park (SEKI) and was a satellite site focusing on the timing of prescribed fire, comparing early season burns to late season burns.

At each site, three replicates of each treatment and 3 control replicates were randomly assigned to treatment units ranging in size from ~15 – 30 ha. Within each of these treatment units we randomly selected 10 of the established FFS plots to collect habitat data in a manner consistent with recently published research describing habitat selection by fisher in California. We collected habitat data prior to and following treatment implementation to assess treatment effects on fisher habitat suitability, as well as select habitat variables assumed important to fisher.

We assessed habitat suitability using Resource Selection Functions developed from radio-telemetry research and track plate surveys conducted in California from 1993-1997. We compared the differences in predicted probability of resource use (a surrogate for habitat suitability) before and after treatment implementation at both sites.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Our analysis suggests the following:

- FFS treatments had significant short-term effects on habitat suitability for resting fishers at both the BFRS and SEKI sites
- Short-term effects were negligible on fisher foraging habitat suitability

- At BFRS, mechanical and mechanical plus fire treatments had the greatest effect on resting habitat suitability and average canopy closure
- At SEKI, late season burns had greater effect than early season burns

Land managers in the Sierra Nevada who face this resource management challenge can mitigate the short-term effects of fuels management treatments on fisher habitat by taking the following proactive measures when conducting vegetation management projects:

- Plan actions that will maintain habitat elements important to resting fishers (e.g., large conifer snags, large hardwoods)
- Implement early season burns in favor of late season burns
- Time early season burns to avoid the fisher denning season (mid-March through mid-May) whenever possible
- When possible, plan vegetation management activities to disperse treatments over space and time to minimize impact on individual fishers

Efforts should be made to resample the FFS sites at BFRS and SEKI again 5 and 10 years following our initial efforts to assess the potential effect of delayed treatment effects on fisher habitat.

Our final report has been completed and will be provided to FFS site managers, along with field data, by the end of 2005. Manuscript preparation from our research is underway with intentions to submit our work to a peer-reviewed journal before the end of 2005.

Issues/Concerns; changes in research objectives, methods, or products:

JFSP 2004 Principal Investigator Workshop

01C-33-13

Project Title: Effectiveness of Postfire Seeding to Reduce Cheatgrass (*Bromus tectorum*) Growth and Reproduction in Recently Burned Sagebrush Steppe

Project Location: Walker CA

Principal Investigators: Matt Brooks, Anne Halford, Mike Pellant

Contact Information (Phone, e-mail): 702-564-4675, matt_brooks@usgs.gov

Description of Project: The positive relationship between invasive grasses and fire frequency is a major concern for land managers in semi-arid shrublands throughout western North America, particularly in Great Basin sagebrush steppe. Management tools are needed to break this cycle. In this project we evaluated the use of postfire seeding to suppress the growth and reproduction of invasive grasses. We specifically evaluated the seeding of introduced versus native seed mixes, and grasses versus grasses plus leguminous forbs. We also evaluated the postfire soil conditions, such as nutrient level and seedbank composition, that may influence the effectiveness of postfire seeding treatments. Effects of seeding on the species composition and abundance of native plants were also evaluated. These data were compiled during the initial 2 years after burning. We will present this information as a set of recommendations for land managers to use when designing postfire seeding protocols, and as a set of working hypotheses for research scientists to use when formulating new studies to improve our knowledge of fire and invasive species ecology and management in sagebrush steppe.

Status Report:

Insufficient fine fuels for burning during Summer 2002 and 2003, and various other reasons, prevented us from implementing the study as originally planned in Wyoming big sagebrush near Winnemucca, NV. Our proposal included a statement indicating that if the original plan for an experimental burn near Winnemucca did not materialize, we would alternatively apply seeding and nutrient treatments after a wildfire. We chose this latter option, and implemented the study following the Cannon Fire, which burned 22,750 acres of mountain big sagebrush between 15 and 28 June 2002 near Walker, CA. We applied the seeding treatments on 21 November, 2002, followed by nutrient treatments Winter 2002 and 2003. Post-treatment monitoring was completed during spring 2003 and 2004.

The JFSP Board of Directors were led a field trip to the study site during May 2005 to view and discuss the preliminary results of this project with the Principal Investigators.

A project website is now available at www.werc.usgs.gov/fire/lv/postfireseeding/greatbasin/. Manuscripts will be submitted for publication, and fact sheets will be developed and delivered to the JFSP, during FY06.

The project ended, and a final report was submitted at the end of FY05

Issues/Concerns affecting the project:

The study was done after a wildfire in mountain big sagebrush in eastern California, rather than after an experimental burn in Wyoming big sagebrush in northern Nevada. Also, the primary invasive grass dominating the site was bulbous bluegrass (*Poa bulbosa*) rather than cheatgrass (*Bromus rubens*).

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fire Regimes and Forest Reference Conditions for Prescribed Fire Management of Relic Mixed Conifer Forests in Guadalupe Mountains National Park, Texas

JFSP Project No.: 01C-3-3-25

Project Location: Guadalupe Mountains National Park, Pine Springs, TX

Principal Investigators: Richard Gatewood, Dr. Alan H. Taylor, Fred Armstrong, Paul Schmidtke, Kathy Davis. Tim Stubs and Ellis Richard have retired.

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Brief Description of Project: National Park Service policy mandates that land be managed to maintain conditions that evolved with natural processes as opposed to those caused by human action. The goal of this project is to provide managers with a quantitative ecological reference for forest conditions and fire regimes for the pre-fire suppression period in a ca. 6,000 ha relic high elevation mixed conifer forest in Guadalupe Mountains National Park. The project was needed to fill gaps in knowledge needed to develop and implement the parks fire management plan. Forests are variously dominated by southwestern white pine, Douglas-fir, ponderosa pine, gambel oak, pinyon pine, and juniper depending on site conditions. The forest structure and fire regime reference can be used to evaluate current conditions and to develop and implement restoration treatments. Quantitative reference conditions included detailed information on forest structure and composition and the frequency, season, and return interval of fire. Spatial and temporal variability in fire regimes will be assessed with regard to topography and forest composition.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Field work and analysis for the proposed work has been completed. A one-year no-cost extension was approved to date a widespread tree mortality event that added fuels to the forest, extend the fire history into the adjacent Lincoln National Forest, and synthesize this new information with work already completed. Key results include:

- Fire scars were identified and dated in 313 wood samples in the study area
- Fires scars indicate a predominance of spring burns (67% 1st one-third of earlywood, 24% 2nd one-third of earlywood)
- The average interval between any sized fire was shorter before Euro-American settlement (2.7 years) than in the settlement period (8.4 years) or fire exclusion period (>60 years)
- Widespread fires that scarred 25% or more of fire scar samples had an average return interval of 15 years
- The average point fire return interval was 24 years
- Fire return interval length was similar ($P > 0.05$) on all slope aspects and slope positions
- Fire exclusion did not occur until 1922 when the land became a ranch and the fire decline was caused by grazing

- Forest structure was quantified for the years 1922 and 2003 in 160 plots
- Forests in 2003 have two-eight-fold more trees than in 1922
- Forests in 2003 have two-four-fold more basal area than in 1922
- Forests had a multi-aged structure indicating that fires were historically low or moderate in severity
- Introduction of fire to reduce fuels and thin forests is warranted based on the reference conditions
- A strategy of bounding burn units by topographic features such as stream courses, aspect changes, and ridgetops is a tactical approach consistent with pre fire exclusion burn patterns
- Early results were shared with managers at two presentation (GUMO; Carlsbad Interagency Fire Center) followed by discussion. The results were used in the development of a draft fire management plan for the park. A workshop to share final results with managers and to get feedback from managers on packaging content of the final report for effective use by managers is planned for Spring/Summer 2006
- To assist managers in understanding the direction and magnitude of forest changes since fire exclusion visualizations of forest stands and the forest landscape were developed
- Papers on forest and fire regime changes in southwestern mixed conifer forests were given at two professional meeting.
- One Masters Thesis in Geography at Penn State (Sakulich, J. 2005 Fire regimes and forest structure in mixed conifer forests in the Guadalupe Mountains, Texas) was completed
- A paper detailing forest and fire regime changes in one part of the study area has been completed and submitted for publication. An additional publication will be completed and submitted when the work from the Lincoln National Forest, and on tree mortality is completed.

Issues/Concerns; changes in research objectives, methods, or products:

A one-year no cost extension was requested and approved to identify the timing and extent of a tree mortality event and to sample fire scars in the Lincoln National Forest. Field collections have been completed and laboratory work is underway.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Climate drivers of fire & fuel in the Northern Rockies: Past, Present & Future

JFSP Project No.: 03-1-1-07

Project Location: Data have been collected from Idaho, Montana, and Washington.

Research conducted at University of Idaho, Latah County, Moscow, ID, First Congressional District; Fire Science Laboratory and Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station, USDA Forest Service, Missoula, MT, First Congressional District

Principal Investigators: Penelope Morgan, Emily Heyerdahl, Carol Miller, Matthew Rollins

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Matt Rollins, 406-329-4960, mrollins@fs.fed.us

Brief Description of Project: This 3-year research project is identifying the climate drivers of regional fire and fuel dynamics in the Northern Rockies in the past, present, and future. We are identifying regional fire years from two sources: multicentury tree-ring reconstructions and multidecadal fire atlases. To elucidate the climate forcing of past fires, we have reconstructed the occurrence of regional fire years from synchrony in fire-scar dates among 15 widely separated sites (we will soon have 34). To elucidate present, i.e., twentieth-century, climate forcing of fires, we have joined together digitized fire atlases from 10 national forests and 2 national parks in the region. Despite their potential for identifying synchronous and extensive regional fire years, fire atlases have not yet been used to assess regional fire-climate relationships. To elucidate future climate forcing of fire, we will simulate the future consequences of fire and fuels management for four different landscapes chosen with input from local managers. We are parameterizing the simulation model TELSA with the past and present climate forcing we derive from fire atlases and fire scars. Our results will be summarized by fire regime condition class. We plan to submit 5 manuscripts to refereed journals and we are educating two M.S. graduate students; we employ a full-time technician as well. To ensure that our results are useful to fire managers, we will present our results at national, regional, and local meetings with scientists and managers. Increasingly, it is possible to predict climate for future fire seasons, so our information will help fire managers anticipate when fire management must focus primarily on fire suppression versus fuel management, and where such fuel management is likely to affect fire behavior during future regional fire years. Our research thus addresses Task 1 of JFSP AFP 2003-1, which calls for *"characterizing past, present and future fuel and fire regimes"* under *"changing climate and altered climate variability"*. Through planned workshops and technology transfer activities, we will also provide *"applications for...long-range fire management planning"*.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Our project is progressing very well. We collected field data in 2004 and 2005, and are currently analyzing those data and interpreting the results. Field work will be completed by the end of October 2005. We have employed an excellent full-time technician since Nov. 2003 and two outstanding graduate students since January 2004. Both graduate students have also accepted SCEP positions with the USDA Forest Service.

Our research accomplishments to date:

- By October 2005, we will have collected fire history data from 34 sites across Idaho, western Montana and eastern Washington. Currently, we have dated fires from 15 of these sites, with fire dates spanning more than 250 yr, from 1650 to 1900. From the synchronous fire events, we will identify regional fire years from the last 250 yr and compare these to climate indices, including the Palmer Drought Severity Index, El Niño-Southern (e.g. NIÑO3), Pacific Decadal

(PDO), and Multidecadal Atlantic (AMO) oscillations, to test our hypothesis that climate during regional fire years is distinctly different from other years, and to identify the climate correlates and interactions. Already, our preliminary results from analysis from 15 sites show that regional fire years are significantly drier than other years, and associated with high values of Niño3 index when PDO was positive. There was no significant effect of wet or dry antecedent years.

- Completed the gridded sampling for comparing age structure and fire scar records to fire atlas data at the Powderhouse Gulch site in central Idaho (near Crouch). Preliminary analysis suggests that there is little agreement of either fire extent or date between dated fire scars and fire atlas data. In this dry, unproductive site, tree establishment seems to be independent of disturbance. Fires were historically less frequent here (mean fire interval >30 yr) than in other ponderosa pine sites, which is probably a reflection of the site conditions as well. We will further evaluate the spatial agreement (or lack thereof) between gridded fire scar dates and the fire atlases with additional data collected in summer 2005 in Idaho. In addition, we will analyze similar data from 3 other watersheds in eastern Washington. We will also analyze the 20th-century fire scar record on the Powder Gulch Study area (Boise NF, near Crouch, ID) in light of the longer term data collected from three adjacent sites (Lowman, Warm Springs Ridge, Bannock Creek, all from Boise NF) as part of our study.
- Assembled fire atlas data for the entire region (10 national forests and two national parks) and combined all data into a single database with consistent architecture and complete metadata. All data have been subjected to error checking and data consistency checks. This challenging effort occupied much of last year.
- Both graduate students are making excellent progress on their MS programs based, in part, upon this research project. Both are in SCEP positions with the USDA Forest Service.

Technology transfer accomplishments to date:

- All error-checked fire atlas data have been provided to the cooperating national forest and parks.
- During July 2005, our project helped to host the 15th Annual North American Dendroecology Field Week. Penny Morgan presented our preliminary results to the 45 participants and scientists from throughout the US, as well as Canada and Sweden. Participants collected field data to supplement our dated fire scar data.
- In May 2005, Emily Heyerdahl presented preliminary results of our analysis to a national workshop on fire-climate relations. There is considerable interest in our results, in part because other research by T. Westerling and others suggests that fire-climate relationships in the northern Rocky Mts. are pivotal to understanding fire-climate relationships across western North America.
- Our project web site is available through FRAMES (www.frames.nbii.gov). The web site contains a short project description, information about the people doing the project, links to our organizations and the Joint Fire Sciences Program, as well as a copy of the full proposal. Links to project products will be included.
- In late August, the first of a series of electronic updates on research results will be sent to fire management staff throughout the region.

Issues/Concerns; changes in research objectives, methods, or products:

We are making excellent progress toward completion of this project, as planned, in September 2006. Thanks to the excellent cooperation from managers of national forests, national parks, and state and private lands, and to outstanding work by graduate students and technician, and the effective collaboration among our team, we are moving ahead rapidly, with very solid progress.

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: Modeling surface winds in complex terrain for wildland fire incident support.

JFSP Project No.: 03-2-1-04

Project Location: Missoula, MT

Principal Investigators: Mark Finney, Larry Bradshaw and Bret Butler

Contact Information (Phone, e-mail): 406-329-4801, bwbutler@fs.fed.us

Brief Description of Project:

One major source of uncertainty in fire behavior and fire behavior modeling is the spatial variation in wind fields.. Mountainsides, valleys, ridges, and the fire itself, influence both the speed and direction of wind flows. Small scale surface wind variations cannot be predicted by synoptic forecasting methods or on-site observations and are therefore not available to fire modelers. This project is a "proof of concept project" with three objectives: 1) develop a methodology for using commercially available CFD tools to produce high resolution surface wind maps and 2) quantify the effect of high resolution surface wind data on fire behavior predictions from the FARSITE software package, and 3) address the fundamental science question of the practical potential for modeling fire-induced changes to the wind fields.

Status Report:

The research team has successfully demonstrated that computational fluid dynamics (CFD) based wind simulation technology can provide a valuable benefit to fire planning and fire management operations at both the small scale (~100m) as well as the landscape scale. It has been applied on over 300 wildfires, more than 30 prescribed fires, and 5 fire incident reconstructions over the last three years. The technology is currently being used in a prototype form by a small group of fire modeling "super users". CFD based surface wind modeling demonstrated its utility in more than 260 wind simulations on approximately 30 separate fire incidents in the Western U.S. in 2003. All deliverables identified in the original proposal have been met. 2003 was spent developing the methodology by which surface wind information could be produced and the team supported wildland fire incident teams throughout the western U.S. 2004 was spent streamlining the simulation process and evaluating the accuracy of CFD based wind simulations. 2005 has been spent identifying new applications for the technology and laying the foundation for the final development of the stand-alone surface wind simulation tool. Presentations describing this technology have been presented in more than four conference papers and many other informal meetings.

Issues/Concerns; changes in research objectives, methods, or products:

This effort forms the first phase of a three phase effort. The second phase will result in the development and testing of a standalone software tool that will permit any computer literate user to develop their own wind simulations using only a laptop computer and digital elevation models of their area of interest. The JFSP board has generously supported this by granting an extension to the PI's to continue efforts on the first phase through 2005 in the hopes that additional financial support for the second phase can be obtained in 2006. The third phase will apply this technology to further research into the interactions between fire and wind flow.

2005 JFSP Principal Investigator Workshop

Project Progress Report

03-2-3-22

Project Title: Post-fire Erosion and the Effectiveness of Emergency Rehabilitation Treatments over Time

JFSP Project No.:

Project Location: Ft. Collins, CO; Moscow, ID

Principal Investigators: Lee MacDonald, CSU; Peter Robichaud, RMRS

Contact Information (Phone, e-mail): 208-883-2349 probichaud@fs.fed.us

Brief Description of Project:

Measure erosion rates after wildfires and evaluate the effectiveness of treatments to reduce post-fire erosion. Specific treatments being evaluated include mulching, hydromulching, scarification and seeding, and the application of a polyacrylamide; the erosion rates from these treatments are being evaluated relative to untreated controls. Quantify the relative importance of different controlling factors on post-fire erosion rates, and quantify changes in erosion rates over time. Use the resulting information and understanding to test and improve models for predicting post-fire runoff and erosion risks, and determine the extent to which erosion rates and predictive models can be transferred between the small plot, hillslope, and small watershed scales.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Studies initiated after the 2002 Hayman Fire in the Colorado Front Range include point-scale measurements of post-fire soil water repellency, plot-scale rainfall simulations, hillslope-scale measurements of rill erosion and sediment production, and measurements of runoff and sediment yields from 2-5 km² catchments.

Preliminary results show that nearly all of the postfire erosion results from summer thunderstorms rather than frontal storms or snowmelt. In severely burned areas, overland flow can be initiated by as little as 5 mm of rainfall and rainfall intensities of only 10 mm hr⁻¹. Burning reduces the percent ground cover from more than 90 percent to less than 10 percent. Continuing ground cover measurements indicate that the amount of bare soil in most of our study sites has dropped from over 90% in summer 2002 to less than 50% in summer 2005.

Both the rainfall simulations and the hillslope-scale sediment fence data show that sediment yields are strongly correlated with percent ground cover and rainfall intensity. Soil water repellency plays a lesser role. Sediment yields are highest when the percent ground cover is less than 30-40 percent. Because the amount of ground cover was below this threshold in the summer immediately after burning and summer 2003, there was little evidence of a decline in sediment production rates. By the third summer after burning there was sufficient ground cover to reduce sediment yields, but the higher rainfall intensities in summer 2004 sustained relatively high sediment production rates. Sediment production rates dropped sharply in summer 2005 due to the continuing vegetative recovery and lower amounts of summer rainfall.

Because percent cover plays such a strong role in controlling post-fire erosion rates, the most effective rehabilitation techniques are those that immediately provide cover, such as mulching. Seeding and scarification does not significantly increase percent cover or reduce erosion rates

relative to untreated sites; the polyacrylamide treatment also was ineffective.

The measured hillslope erosion rates are being compared against predicted values from two commonly-used models—the Revised Universal Soil Loss Equation (RUSLE) and the Water Erosion Prediction Project (WEPP). The predicted values using WEPP were more accurate than the predicted values using RUSLE, but neither model could account for more than 20-25% of the observed variability in hillslope-scale erosion rates, even when the measured rainfall values were incorporated into the models. In contrast, an empirical model using contributing area, percent ground cover, and rainfall erosivity could account for more than 50% of the observed variability.

Four M.S. students have been working on this project, and three of these students are now finishing up their theses. Data from this project was incorporated into three chapters in the Hayman Fire case study, two journal articles, and ten presentations at Professional Meetings and Regional Workshops were done. One new student began working on this project in summer 2005.

Issues/Concerns; changes in research objectives, methods, or products:

Sediment production rates in summer 2005 were relatively low, but it is difficult to separate the effect of lower rainfall from the effect of increased ground cover. Because sediment production rates were relatively low, a small absolute difference can result in a large percentage difference, and the use of percent differences may make some of the rehabilitation treatments appear to be more effective than might normally be the case (i.e., a 50 percent reduction in erosion sounds impressive, but may be small in absolute terms if erosion rates are unusually low). For this reason it will be important to report our results in absolute terms.

Future work will continue our efforts to test and develop models. In particular, we will use our field data to test the newly-developed Erosion Risk Mitigation Tool (ERMiT). The testing of this model is somewhat problematic because it is probabilistic and only predicts erosion rates from larger storms (i.e., a recurrence interval of 2 years or more). The lack of data from large storm events will hinder the testing of this model, but preliminary comparisons suggest that the measured erosion rates tend to be higher than predicted by ERMiT.

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- Kershner, J.L., L. MacDonald, L.M. Decker, D. Winters, and Z. Libohova, 2003. Fire-induced changes in aquatic ecosystems. In R.T. Graham (ed.), *Hayman Fire Case Study*, Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, pp. 232-243.
- Robichaud, P., L. MacDonald, J. Freeouf, D. Neary, and D. Martin, 2003. Post-fire rehabilitation of the Hayman Fire. In R.T. Graham (ed.), *Hayman Fire Case Study*, Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, pp. 293-313.
- Wagenbrenner, J.W., L.H. MacDonald, and D. Rough. In press. Effectiveness of three post-fire rehabilitation treatments in the Colorado Front Range. *Hydrological Processes*.
- Benavides-Solorio, J. L. H. MacDonald. In press. Measurement and prediction of post-fire erosion at the hillslope scale, Colorado Front Range. *International Journal of Wildland Fire*.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Prescribed burning to protect large diameter pine trees from wildfire - Can we do it without killing the trees we're trying to save?

JFSP Project No.: 03-3-2-04

Project Location: Eagle Lake District of Lassen National Forest and Lassen Volcanic National Park, California

Principal Investigators: Sharon M. Hood and Michael Harrington

Contact Information (Phone, e-mail): (406) 329-4818, shood@fs.fed.us

Brief Description of Project: There is growing concern from the National Park Service and the US Forest Service in northern California that prescribed burning to reduce fuel in areas with large diameter and old-growth trees is causing increased mortality of these high-value trees. A probable cause is the extended burning of large duff accumulations resulting from 100 years of fire suppression. Burning when duff moistures are low can lead to root mortality and basal girdling from the duff mounds smoldering. Even with mechanical thinning to reduce ladder fuels and the probability of crown damage, the problem of deep duff mounds and below-ground damage still exists. In order for managers to create successful prescribed burn programs that reduce fuel and restore areas to near historical conditions, information is needed on duff and litter depth, their impacts when burned on tree survivability, and methods for their manipulation that are effective, quick, and inexpensive. We initiated a study in 2003 to 1) evaluate the economic feasibility and biologic effectiveness of raking duff mounds away from trees to reduce large tree mortality and 2) develop prescribed fire guidelines to reduce damage to large-diameter ponderosa and Jeffery pine in areas of deep duff. By removing duff, managers could potentially burn under a wider range of weather conditions and different seasons, leading to more acres treated with less large-diameter tree mortality and fewer bark beetle attacks. This effort will give prescribed fire managers and line officers better criteria when making prescribed burn decisions for areas containing large diameter trees.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- In June 2005, the site in Lassen Volcanic National Park was successfully burned.
- Initial results from the belowground thermocouple data show the soil reached temperatures over 60° Celsius at a depth of 1 cm and reached 40° Celsius at a depth of 10 cm for over 10 hours with 11 cm of duff and litter consumption.
- Analysis of the soil, duff, litter, and fine fuel moisture samples is ongoing.
- In August, we will assess each sample tree for crown scorch and cambium injury.
- A comparison of actual duff consumption with FOFEM predicted consumption using known fuel moistures will be completed this fall.
- Trees will be reassessed for three years following burning for mortality and bark beetle attacks.

Issues/Concerns; changes in research objectives, methods, or products: The prescribed burn for the Greys Flat site on the Lassen National Forest was not accomplished in the spring. The site is now scheduled for burning the fall (2005).

JFSP 2004 Principal Investigator Workshop

03-23-58

Project Title: Effects of Fuel Management Treatments in Piñon Juniper Vegetation at a Site on the Colorado Plateau

Project Location: Shivwitz Plateau, Mojave County, Arizona

Principal Investigators: Matt Brooks, Curt Deuser, Helen Smith, Kevin Oliver, Henry Bastian, and Todd Esque

Contact Information (Phone, e-mail): 702-564-4615, matt_brooks@usgs.gov

Brief Description of Project: Piñon-juniper woodlands have expanded beyond their historical range in the western United States, due partly to land management practices such as fire suppression that began with settlement of the region in the late 1880s. This woodland expansion has replaced sagebrush steppe vegetation, leading to decreased wildlife habitat, soil seedbanks, and plant species diversity, and increased potential for soil erosion and high intensity crown fire. In an attempt to restore historical conditions, "post-settlement" trees have been removed to free resources for sagebrush steppe vegetation to become re-established. Mechanical and chemical thinning methods have recently replaced chaining as the primary thinning tool, often followed by seeding and/or burning. Unfortunately, the cost-effectiveness and ecological effects of various combinations of thinning, seeding, and burning remain mostly unknown, making it difficult for land managers to develop effective management plans.

This project is designed in two phases. Phase 1 will compare the cost effectiveness of two types of mechanical and one type of chemical thinning treatment, alone and when combined with seeding treatments, and evaluate the abilities of these treatments to: (1) reduce densities of post-settlement piñon and juniper trees; (2) increase cover and seedbank density of annual plants and perennial grasses; (3) increase plant species diversity; (4) minimize cover and seedbank density of invasive alien plants; and (5) create a fuelbed that promotes the re-establishment of historic low to moderate intensity ground fires. Thinning targeted 80% reduction in post-settlement pinyon and juniper trees using cut-leave, cut-buck-scatter, herbicide, and untreated control treatments each applied to 8 replicate 20-acre plots (n=32 total plots). The second phase, pending additional funding beyond the scope of this proposal, will add fire as a treatment and compare fire behavior among previous thinning and seeding treatments.

Status Report:

Pre-treatment vegetation sampling was completed, and thinning treatments were implemented in FY03. Post-treatment year 1 sampling was completed during spring and summer FY04, and year 2 sampling was completed in spring and summer FY05.

Year 1 results suggest that the herbicide treatment can produce the most immediate increase in herbaceous cover and diversity, and is the least expensive, compared to the two mechanical treatments. Final results and recommendations will be available at the end of FY06.

A project website now available at <http://www.werc.usgs.gov/fire/lv/pj/lakemead/>

Issues/Concerns: Phase 1 of this project is proceeding as originally planned, and will be completed in FY06. We are considering the development a Phase 2 proposal for submission in December FY05 or FY06. This proposed follow-up study would compare fire behavior among the previously thinned and/or seeded treatment plots.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: New technology for monitoring smoke characteristics

JFSP Project No.: 04-1-1-04

Project Location: Rocky Mountain Research Station, Missoula, MT, congressional district: MT

Principal Investigators: Wei Min Hao and Vladimir Kovalev

Contact Information (Phone, e-mail): 406-329-4838; whao@fs.fed.us

Brief Description of Project: Particulates emitted by wildfires and prescribed fires can severely affect visibility and air quality resulting in car accidents, airport and road closures, and public health problems. Researchers have developed a new remote-sensing instrument (lidar) and are now calibrating and testing this and auxiliary instrumentation and new operative technologies for real-time measurements of smoke particulates emitted by fires over a large area. This information will enable managers and public officials to assess and predict effects on visibility and air quality allowing for better preparation for these events. This is one of several projects targeted at understanding and predicting smoke movement under different environmental conditions.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- In cooperation with the Johns Hopkins University (Baltimore), we developed integrated software, which allows the application of our new multiangle-measurement methodology and algorithms to determine the vertical profiles of atmospheric optical depth in the vicinity of forest fires contaminated with smoke particulates.
- Over the period from March to April, 2005, the Fire Sciences Laboratory lidar was operated side by side with the Johns Hopkins University's lidar to verify and adjust the new multiangle measurement methodology and related data-processing software. This work was summarized in two papers, which describe the theoretical basis of the new methodology and the experimental results. The papers were submitted for publication in the Applied Optics journal.
- We continued thorough tests and examination of the methods of lidar calibration in clean atmosphere during the 2004-2005 winter seasons and developed a new method and software for determining the effective lidar overlap.
- A custom vehicle designed to transport and house the lidar during field campaigns was delivered in Feb. 2005 and used for transportation of the lidar and auxiliary *in-situ* instrumentation to the area of the wildfires in New Mexico and Montana.
- During the final week of June 2005 the lidar was successfully deployed to the Bull Fire in the Black Range Complex in New Mexico's Gila National Forest. Aerosol backscattering data of diffuse smoke and smoke plumes were collected during the four days of deployment. The lidar measurements were accompanied with *in-situ* measurements of aerosol particle properties by a three wavelength TSI nephelometer, a Radiance Research integrating nephelometer, a scanning mobility particle sizer SMPS, and an aerodynamic particle size spectrometer (APS). In August 2005, the lidar was deployed to several wildfires along the Interstate I-90 in Montana. The intense smoke layers at the heights of 2-4 km were monitored and measured during the seven days of

deployment.

- We developed an improved method for extracting the vertical profiles of the smoke-particulate extinction coefficient from the lidar multiangle-measurement data and tested it with simulated and experimental data for altitudes up to 2 km.

Issues/Concerns; changes in research objectives, methods, or products:

The instrument van for the lidar, which took 2 years to obtain after the procurement process was initiated, does not meet the payload specifications. Due to the inadequate payload, the ability to deploy the lidar and auxiliary instrumentation for field measurements is limited. The van can only be deployed locally until the remedy of the van's payload issue is resolved.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Mapping and analysis of pre-fire fuels loading and burn intensity using pre-fire interferometric synthetic aperture radar data combined with burn intensity derived from post-fire multispectral imagery for the 2003 southern California fires

JFSP Project No.: 04-1-2-02

Project Location: San Bernardino NF (CA), Angeles NF (CA), and Los Padres NF (CA)

Principal Investigators: Hans-Erik Andersen and Robert McGaughey

Contact Information (Phone, e-mail): Hans-Erik Andersen 206-685-3073

hanserik@u.washington.edu

Brief Description of Project: In 2003 15 large fires consumed more than 750,000 acres in southern California. Coincidentally, a pre-fire, high-resolution interferometric radar dataset was collected in 2002/2003 by NOAA that covers most of the major burned areas from Santa Barbara to the Mexican border (~10 million acres). These data were collected with the GeoSAR interferometric synthetic aperture (IFSAR) radar system and are available from NOAA for analysis. Also, high-resolution multispectral imagery was flown over all major burned areas (~2 million acres) and used to produce burned area orthophotographs immediately after the fires. This post-fire imagery (along with BAER team fire intensity maps) is also available from ERSI / San Bernardino National Forest. In this project, we propose to: install and measure a limited number of vegetation field plots in unburned areas surrounding 3 major burned areas to augment existing national forest, CDF, FIA and NRI pre-fire inventory plot data; develop regression relationships between these ground plot vegetation data; use these regressions to map vegetation density, structure, and fuels throughout the burned and unburned areas of the 3 major fires; compare these vegetation density/structure maps with burned area assessment maps (vegetation mortality, soil severity) developed by the BAER program; conduct an analysis to determine if the IFSAR vegetation density/structure maps are well-correlated with the post-fire high-resolution multispectral orthophotography images and finally, make recommendations on whether or not it is desirable to process the entire NOAA IFSAR dataset to develop fuels maps throughout the 5 county area.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Twenty field plots were established within San Bernardino NF and Angeles NF in summer of 2004 in a variety of vegetation types, including mixed-conifer, chaparral, and grass, and across a range of aspects and slope conditions. More field plots will be established in Los Padres NF in summer, 2005. These plots were located in unburned areas that were representative of the vegetation types that burned in 2003.
- Field plots have been precisely georeferenced using differential GPS and laser surveying equipment

- To augment the field measurements, high-density LIDAR data have also been collected over the field plots in summer, 2005. The detailed forest structure information provided by this LIDAR data can be used to expand the scope of analysis to larger areas within the IFSAR data, allowing for more robust conclusions.
- LIDAR/IFSAR data visualization software (*FUSION*) is currently in development
- Preliminary results at the Capitol Forest study site have indicated a high correlation between X-band/P-band IFSAR metrics and field-based plot-level fuel estimates (canopy height: $R^2=0.88$; canopy base height: $R^2=0.87$; canopy bulk density: $R^2=0.78$; canopy fuel weight: $R^2=0.80$)

Issues/Concerns; changes in research objectives, methods, or products: Preliminary analyses have indicated that the quality of the P-band IFSAR-derived digital terrain models in southern California was degraded due to the severe notching of the waveform that was required by the FCC. However, technical personnel at Earthdata (the data provider) have indicated an interest in flying the study sites again in an experimental mode to obtain a higher quality dataset for this project. We are also investigating the use of textural information provided by the high resolution X-band reflectance data in classification of vegetation type and condition.

**2005 JFSP Principal Investigator Workshop
Project Progress Report**

Project Title: Multi-Jurisdictional Application of ForestERA Landscape Decision Support Tools in North-Central New Mexico

JFSP Project No.: 04-2-1-27

Project Location: North-central NM (study site map available at www.forestera.nau.edu)

Principal Investigator: Thomas D. Sisk

Contact Information (Phone, e-mail): 928-523-7183, thomas.sisk@nau.edu

Brief Description of Project:

We are developing a decision support system based on spatial analytical approaches pioneered by our team (ForestERA Project) to meet the specific planning needs of north-central New Mexico. Federal, state, local and tribal managers are participating in its development and will be able to use this decision support system to a) create a scientific foundation for their annual programs of work for fuels reduction and forest restoration; b) to communicate about landscape-scale priorities and coordinate management actions across jurisdictions; c) to leverage fuels treatment funds and resources to better achieve restoration goals; and d) to establish baseline conditions to monitor changes in wildfire and forest conditions at the landscape scale. Several products will be provided to stakeholders at the end of this project, including: 1) spatial data layers of forest structure (canopy closure, basal area, tree density, and dominant vegetation), fire risk and hazard, watershed risks, and wildlife species of concern (including Northern Goshawk and Mexican Spotted Owl); and 2) software tools to develop, explore, rank, and choose between alternative restoration scenarios and. In addition, we are carrying out an independent evaluation of the tools and processes developed using quantitative approaches from the social sciences.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Held project kick-off meeting in Santa Fe, NM, to inform and engage local partners.
- Completed stakeholder needs assessment with input from over 50 individuals representing 30 local, state and federal agencies, institutions, and non-profit organizations.
- Developed and distributed a draft data atlas describing spatial data collected to date and products under development in our lab.
- Acquired Landsat imagery for entire study site for developing vegetation models.
- Developed vegetation plot sampling design.
- Refined methods for mapping piñon pine and juniper ecosystems using airphoto data.
- Formed an agreement for vegetation field data collection with Santa Clara Pueblo.
- Developed project web page to keep sponsors and partners informed of project developments (http://jan.ucc.nau.edu/%7Efera-p/overview_nnm.htm).
- Established on-going correspondence for updating collaborators and developed and distributed the first edition of an email newsletter to project stakeholders.
- Developed a brochure communicating need for landscape scale analysis and the ForestERA spatial decision support system.
- Completed collection of baseline "Q-sort" data as part of the social science evaluation of the ForestERA process. (Two additional Q-sorts will be conducted in 2006, with the same participants, before and after participatory workshops are held.)

Issues/Concerns; changes in research objectives, methods, or products:

As part of the Needs Assessment process, we adjusted the study site boundaries to better encompass areas of concern to local stakeholders.

JFSP 2005 Principal Investigator Workshop

Epidemic Southern Pine Beetle Attacks: A Problem of Fuel-Loading or an Opportunity for Management?

JFSP Project No.: 04-2-1-33

Project Location: Principal Investigators: Thomas A. Waldrop

Contact Information (Phone, e-mail): (864) 656-5054, twaldrop@fs.fed.us

Description of Project: The Piedmont Region of South Carolina has experienced one of the heaviest attacks of southern pine beetle (*Dendroctonus frontalis*) in history. Separate managers with both commercial objectives and restoration objectives have requested information on how prescribed burning or mechanical treatments can be used to reduce the heavy fuels resulting from these attacks, without neglecting their primary management objectives. Prescribed burning is of concern because intensities are expected to be high and fires may damage soils, neighboring trees, or target vegetation. Methods of predicting fire behavior and fuel consumption are unavailable. Mechanical treatments will reduce fuels but are expensive and may not control vegetation that would out-compete planted pines, oak sprouts, or other target vegetation. The project uses beetle-killed areas on a commercial forest and a national military park as treatment areas to compare winter burning, summer burning, and mechanical fuel reduction. Response variables will include vegetation inside and outside of beetle-killed areas, soil fertility and structure, fire behavior, and fuel reduction. Resulting analyses will provide local managers a better understanding of the tradeoffs between prescribed fire and mechanical fuel reduction in areas with unusually heavy fuel loads.

Status Report: The study began in late summer 2004. Study areas were located on the Clemson Experimental Forest (commercial forest) and the King's Mountain National Military Park (restoration forest). Twelve treatment areas were located at each site for 3 replications of 4 treatments. Treatments are somewhat different at the two sites to accommodate local manager interests. The Clemson site has an untreated control, a mechanical treatment, and prescribed burns of low and high severity. Treatments at King's Mountain include an untreated control, a mechanical treatment, prescribed burning, and mechanical + burning. The mechanical fuel reduction treatment has been completed at both sites by July 2005. This treatment used a chipper which reduced all beetle-killed trees to mulch. The mulch covered study plots and was as deep as 0.5 m in some areas. Prescribed burning will be conducted in summer or autumn of 2005. Pretreatment measurements of fuels and vegetation were completed in December 2004. Post-treatment measurements will begin as soon as burning is completed.

Issues/Concerns affecting the project: Prescribed burning is behind schedule at both study locations. Frequent (almost daily) rainfall during May and June has delayed this plan.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of 40 Years of Prescribed Fire on Pine Regeneration and Productivity.

JFSP Project No.: 04-2-1-35

Project Location: Santee Experimental Forest, South Carolina

Principal Investigators: C. Trettin

Contact Information (Phone, e-mail): 843-769-7002, ctrettin@fs.fed.us

Brief Description of Project:

The Santee Fire Plot is among the oldest ongoing prescribed fire studies in the United States. The study was established in 1946 to test the effects of fire frequency and seasonality on pine growth, vegetation, and soil properties. The treatments comprised a factorial of periodic and annual, summer and winter burns. After 40 years of burning there were no apparent deleterious effects of the treatments on pine growth or soil fertility. In 1989, the stand was destroyed by hurricane Hugo, and a new stands was regenerated on the treatment plots. The plots have not been burned since 1989 to allow for stand establishment. This objective of this study is to ascertain the cause of the apparent differences in productivity and stand composition on the regenerated study plots; or more specifically, address why does the regenerated stand show an effect from the legacy of fire treatments when there was no apparent soil damage from the fires? This study provides an assessment of the vegetation, productivity and soil biogeochemistry in an attempt to address this critically important question. The current work will also provide a benchmark for continuing the fire treatments, now that the stand is of sufficient stature. The findings from this work may have significant implications with respect to interpreting short-term fire effects studies, and cause us to rethink our approaches for measuring and monitoring site responses.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The project is proceeding according to the original schedule, with all field work completed and laboratory analyses ongoing.
- Analyses of the productivity data is suggesting that (1) the previous studies on the plots which utilized mature stands were not representative of long-term responses; and (2) that regeneration may be more sensitive to changes in soil chemical and physical properties.
- A workshop was held in November, 2004 with scientists and National Forest staff to review the current state-of-knowledge of prescribed fire on soil productivity. The workshop provided a forum to discuss issues associated with soil-fire effect studies and the need for long-term research.
- A second workshop was held in November, 2004 to brief Francis Marion National Forest staff on the history, use and effects of prescribed fire in the Coastal Plain.

Issues/Concerns; changes in research objectives, methods, or products:

- None, at this point.
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2005 JFSP Principal Investigator Workshop

Project Progress Report

JFSP Project No.: Quality Assurance of Weather Data and the Probability of Favorable Weather for Prescribed Fire in Alaska.

JFSP Project No.: 04-2-1-71

Project Location: Seattle, Washington and Fairbanks, Alaska

Principal Investigators: Sim Larkin, Martha Shulski, and Sharon Alden

Contact Information (Phone, e-mail): Sim Larkin, 206-732-7849, larkin@fs.fed.us

Brief Description of Project:

This project will correct data availability and quality assurance problems surrounding the Alaskan Remote Automated Weather Station (RAWS) and other Alaska weather station data. By placing all Alaska weather station data into a single quality controlled database, and automating processes for inserting appropriate observations into corporate databases such as WIMS, it addresses the problems of using prescribed fire and forecast tools on Alaska data. This work will also create a suite of automation tools that can be distributed to help provide quality control and timely input into WIMS for other locations.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- All historical station data gathered from a wide variety of sources.
- All data placed in a single standardized database.
- Initial quality control routines written and tested.
- Comparison of gathered historical data with WIMS data complete.
- Preparations for adding additional data into WIMS underway.
- Project website development begun.

Issues/Concerns; changes in research objectives, methods, or products:

This project was delayed in starting due to paperwork issues involved in transferring funds to the University of Alaska. However, at this point we anticipate an on-time completion through redoubled efforts.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Using Cattle as Fuel Reduction Agents in Annual and Perennial Grass Stands in Northern Nevada

JFSP Project No.: 04-2-1-77

Project Location: Utah State University

Principal Investigators: Chris Call

Contact Information (Phone, e-mail): 435-797-2477, cacall@cc.usu.edu

Brief Description of Project: A cooperative study with a local rancher and land managers in the BLM Winnemucca District (northern Nevada) is evaluating the effectiveness of using intensive cattle grazing to reduce fuel loading and fire spread in previously burned areas dominated by cheatgrass (*Bromus tectorum*) and in rehabilitated areas dominated by crested wheatgrass (*Agropyron cristatum*, *A. desertorum*). Grazing is also being evaluated as a method for reducing the seed bank of cheatgrass. Cheatgrass will be grazed at two levels of utilization (80-90% and no grazing) and crested wheatgrass will be grazed at three levels of utilization (50-60%, 80-90%, and no grazing) in spring 2005 and 2006 to manipulate live biomass, seed production, and litter. Fires will be set to burn into fuel reduction treatments in late summer 2005 and 2006, and treatments will be evaluated for their ability to stop or slow fire spread. The BehavePlus fire modeling system will be used to simulate fire behavior in cheatgrass and crested wheatgrass fuel reduction treatments for a range of environmental conditions. The cost effectiveness of using cattle to reduce fuel loads will be compared to conventional fuel reduction practices (using herbicides and mechanical treatments) by obtaining data from BLM field offices in the northern Great Basin. Field tours for local ranchers and land managers, technical articles, and web-based information will be used to disseminate research findings.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Cheatgrass and crested wheatgrass plots were selected and fenced in fall 2004; grazing treatments were applied in May/June 2005; cheatgrass seed production was quantified in late-June 2005 prior to seed dispersal; and cheatgrass seed bank samples were collected in early-August 2005 following seed dispersal.
- Cheatgrass and crested wheatgrass fuel reduction treatments will be burned in early-September 2005; cheatgrass seed bank samples will be collected in mid-September 2005 following burning; and fire behavior simulations will be run with BehavePlus in fall 2005.

Issues/Concerns; changes in research objectives, methods, or products: None

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Does season of burn and burn interval affect soil productivity and processes in a ponderosa pine ecosystem?

JFSP Project No.: 04-2-1-85

Project Location: Burns, Harney county, Oregon (Malheur National Forest)

Principal Investigators: Darlene Zabowski, Walter G. Thies

Contact Information: 206-685-9550 or 541-750-7408, respectively,
zabow@u.washington.edu, wthies@fs.fed.us

Brief Description of Project: Prescribed burning is currently in use in many forests to restore fuel loads to historic levels and return forests to pre-fire suppression burn intervals. A study is currently underway in the southern Blue Mountains of eastern Oregon that is examining the effects of season of burn and fire return interval on forest growth, insect and disease mortality, understory vegetation and fuel consumption. This project has 5 treatments: spring burning at 5-year interval, spring burning at 15-year interval, fall burning at 5-year interval, fall burning at 15-year interval, and a no-burn control. To date, 2 of the 5-year burns have occurred (with the most recent burn in 2002), and 1 has been implemented 6 years ago in the 15-year burn interval plots for both spring and fall burning. No examination of prescribed burning effects on soils has been done at this site, yet prescribed burning may have substantial effects on soil properties. The forests of this semi-arid region could experience changes in both soil water availability and nutrient availability, which could affect forest health. We will examine season of burn and burn interval effects on soil moisture, soil temperature, and nutrient availability and compare these with tree growth, insect and disease-caused mortality of ponderosa pine, and understory vegetation.

Status Report: Due to the flow of funding this is the first summer of field work. Planned field work has been accomplished but data and results are not available yet. We have located 8 sample sites in all experimental units, and collected soil samples from the O, A and upper B horizons at each point. These samples are being processed for chemical and bulk density analysis. Soil horizon depths and hydrophobicity were measured at each sample point. To determine what types of soils occur in the study area, we dug a soil profile in each experimental unit (30 pits), described each profile and collected samples from each major genetic horizon. Soils are being classified. Prior to backfilling each pit, moisture probes were installed (up to 4 per profile depending on profile depth) and one temperature probe. Each pit was set up with a data logger, backfilled, and data collection begun. Over the next year we will monitor soil moisture and temperature.

Issues/Concerns; changes in research objectives, methods, or products:

At this point, there have been no problems with sample collection or instrumentation.

2005 JFSP Principal Investigator Workshop

Project Progress Report

04-21-94

Project Title: *Effects of Fire Severity and Distance from Unburned Edge on Mammalian Community Post-fire Recovery*

JFSP Project No.:

Project Location: CA, San Diego County

Principal Investigators: Wayne Spencer, Jay Diffendorfer, Scott Tremor

Contact Information (Phone, e-mail):

Wayne Spencer, (619) 296-0164, wds Spencer@consbio.org

Jay Diffendorfer, (217) 244-4385, jdiffen@inhs.uiuc.edu

Scott Tremor, (619) 232-3821 ext. 235, stremor@sdnhm.org

Brief Description of Project: Documenting reestablishment patterns of mammal species and communities following the October 2003 wildfires in San Diego County for several years post-fire. Pre-fire fuel status, burn severity, and distance from fire perimeter are primary study covariates. Methods include small mammal trapping, bat detection using Anabat detectors, and carnivore surveys using baited camera stations and other methods. Vegetation surveys are also performed at study plots. Information collected can help guide decisions on the size, location, and intensity of prescribed fires in chaparral to avoid conflicts with wildlife management goals in this biodiversity hotspot.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

We established 40 small mammal study plots across the Cedar Fire, including plots inside and outside of the burn perimeter and across gradients of distance from unburned edge and fire severity. These plots are trapped twice per year for the presence and absence of small mammals and are intensively sampled for vegetation composition. Similar designs were established for bat and carnivore sampling. In addition, more intensive, population-level sampling is being performed at the Rancho Jamul Ecological Reserve (RJER), where pre-fire small mammal population studies were already underway before the area burned.

Planned Science Delivery

- Evaluate the effects of fire on mammals and study patterns of post fire recovery
- Determine the role of burn severity on diversity and patterns of recovery
- Determine the role of distance from burn perimeter on diversity and patterns of recovery
- Elucidate future fire intensity levels and perimeter sizes for prescribed fires
- Determine minimum fire intervals and maximum fire sizes to minimize adverse effects
- Disseminate results in reports, journal articles, public presentations, and other outlets.

Accomplished Science Delivery

- First-year data suggest both burn severity and distance to edge impact certain small mammal species.
- The carnivore and bat data are too preliminary for analysis.
- Vegetation results indicate we are sampling a strong gradient in burn severity.
- Vegetation and small mammal results at RJER show severe impacts on some locations. Two study plots that had some exotic grasses pre-fire are not recovering shrub cover and only support small mammals preferring grassy habitats.

Application Efforts

We are too early in this long-term study to have applicable results.

Deliverables

- Yearly progress reports and a final report submitted to the Joint Fire Sciences Program

- Annual presentations and or meetings with USFS officials and any other interested land managers
- A presentation to the San Diego Partners for Biodiversity, a 70-100 member group of land managers, agencies, and nonprofits who meet monthly to network and discuss management issues.
- Presentations at appropriate conferences or workshops (e.g., at the Third International Fire Ecology & Management Congress to be held in San Diego, November 2006).
- Submission of at least one manuscript to a refereed journal.
- Provide GIS map layers of the data to various local agencies and post to San Diego County Mammal Atlas web page.

Management Implications

All results too preliminary to support management recommendations at this time.

Issues/Concerns; changes in research objectives, methods, or products:

- The project is on schedule and within budget.
- We added annual vegetation surveys and increased large mammal survey sites from 20 to 36.
- We increased the complexity and scope of bat research.
- A bobcat telemetry study is being proposed under separate funding to complement this JFSP with additional data inside/outside of the Cedar Fire perimeter.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Refinement and development of fire management decision support models through field assessment of relationships between stand characteristics, fire behavior and burn severity.

JFSP Project No.: 04-2-1-96

Project Location: Alaska

Principal Investigators: Philip N. Omi, Mary R. Huffman, Colorado State University

Contact Information (Phone, e-mail): phil@cnr.colostate.edu; mhuffman@cnr.colostate.edu
970-451-5550.

Brief Description of Project:

We are using data from video footage plus ocular observations of active wildland fires to test the validity of Canadian and US based fire behavior prediction models that have been developed for the black spruce fuel type in Alaska. We collect live fire video footage using video cameras placed inside fireproof "burnover boxes" and hand held video cameras. We have explored a variety of methods for using these devices safely and effectively in a rapid response wildfire setting.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

1. Accomplished two field seasons of video filming on seven wildfires in Alaska black spruce fuels; four fires were 25,000 to 150,000 acres in size during filming.
2. Used three video filming methods to capture fire behavior in a variety of conditions.
3. Will compare data captured on video to Canada and US-based fire behavior prediction systems; model outputs to be tested include fire type, rate of spread and flame length.
4. Will test fire behavior prediction using new US fuel model TU-3, as well as older Canadian and US fuel model inputs.
5. Assess if and when each fire behavior prediction system under or over-estimates fire behavior, to aid decision-making by firefighters, planners and land managers.

Delivery of additional products include:

1. Website presenting project and making copies of video available for downloading: www.cnr.colostate.edu/~mhuffman/firevideo
2. Fireline video footage made available to Public Information Officer on the Boundary Creek Fire (2005) and used by NBC Channel 2 (Anchorage) for evening newscast.

Suggested methods for researching fire behavior in a rapid response wildfire setting.

Issues/Concerns; changes in research objectives, methods, or products:

1. No change in research objectives; expanded methods and products.
2. Challenge to locate cameras in "burnover boxes" deep enough into the fuels to avoid edge effects in fire behavior while providing safe travel out of the burn area after the camera is turned on manually. Must capture fire on tape within video tape and battery time limits.
3. Desire to further employ remote technology to improve data collection efficiency.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: The effect of spring prescribed fires on nitrogen dynamics within riparian and stream ecosystems

JFSP Project No.: 04-2-1-97

Project Location: Payette and Boise National Forests, Idaho

Principal Investigators: Kathleen L. Kavanagh, G. Wayne Minshall and John Erickson

Contact Information (Phone, e-mail): Phone: 208-885-2552, E-mail: katyk@uidaho.edu

Brief Description of Project: The effects of prescribed fires on nitrogen dynamics in N limited headwater ecosystems in the northern Rocky Mountains of central Idaho are being investigated. This replicated study studies causal mechanisms that regulate nitrogen (N) dynamics between small headwater streams, riparian vegetation and soil following spring prescribed burns. Mechanisms investigated include soil N pool sizes, mineralization and nitrification rates, N retention by terrestrial vegetation and stream biota, and N export in stream water. This study is linked to another project funded by JFSP (wildfire effects on N dynamics, JFSP project number: 05-2-1-41). This project will help land managers to understand the tradeoffs and synergy between fuel reduction programs and watershed ecosystem functions.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Data were successfully collected in 2004 (first season post-fire) and are collected for the second season post-fire (2005). Data analysis is conducted concurrently.
- The results of a preliminary study were presented at the annual Ecological Society of America (ESA) meeting in Portland in 2004. A website has been constructed showing these presentations. A manuscript for publication will be prepared by the end of 2005. Study results were used in 'Advanced Regeneration and Fire Restoration', an extended education course offered to 22 forest management professionals held at University of Idaho in 2005.
- The results of data collected in 2004 were presented at the 2005 annual ESA meeting in Montreal.

Issues/Concerns; changes in research objectives, methods, or products:

- The spring prescribed fire planned for 2004 was postponed to the following year due to inappropriate burn conditions (too dry). As a backup, new replicated prescribed fire sites in the same region were selected and used for the data collection in 2004.
- The planned spring prescribed fire was implemented in 2005. However, due to high fuel moisture levels, burn effects were insignificant for the study purpose. As a consequence, the planned study components in the original study site were reduced and "backup" sites were re-sampled in 2005.
- Due to a lack of pre-burn data at the "backup" sites hypothesis 3 and 4 of the original study (i.e. N retention in aboveground terrestrial biomass and aquatic biota biomass) cannot not be fully addressed. Therefore, emphasis of these hypotheses has shifted from quantitative (N budget approach) to qualitative (stable isotope approach) aspects of N dynamics.
- The measurements of gross nitrogen mineralization rates in soils were not successful due to methodological problems in 2004. Improved methods are being applied in 2005.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Integrating Social Values in Vegetation Models via GIS: the missing link for the Bitterroot National Forest

JFSP Project No.: 04-2-1-114

Project Location: Bitterroot National Forest, Montana

Principal Investigators: Anne Black, Alan Watson, Carol Miller

Contact Information (Phone, e-mail): 406.329.2126, aeblack@fs.fed.us

Brief Description of Project: This project seeks to improve methods for presentation and integration of fuzzy data (social values) in GIS format for use in planning fire and fuels treatments. Information on social effects of alternatives is necessary, at a minimum for NEPA documentation. While there are several possible techniques to accomplish this objective, no GIS-based techniques have been tested sufficiently or peer-reviewed, nor are any theoretically based. We seek to create and refine a theoretical basis for integrating social values into ecologically-based succession-disturbance models, then conduct a proof-of-concept study to allow the Bitterroot National Forest to understand how proposed treatments will affect social values the local public places on forest resources. We will supplement existing data on social values, then associate these to the existing GIS-based SIMPPLLE (SIMulating Patterns and Processes at Landscape scaLEs) vegetation dynamics simulation program and the MAGIS activity scheduler. Integration will allow managers and the public to assess longer-term consequences of alternative fuels, fire and land management activities on at least some social as well as ecological values.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Previous work defined fuels treatment project area. Our study area is the Trapper-Bunkhouse Hazardous Fuels Treatment project area. Choice of this area by the Bitterroot National Forest followed work by Watson and former-PI Gunderson to map the social values residents place on forestlands along the Bitterroot Front.

Initial conceptual model published as research update:

<http://leopold.wilderness.net/research/updates/U005.pdf>. After analysis of new data and additional literature review, this model will be revisited and updated. A manuscript covering the final conceptual model and study methods will be developed and submitted to a refereed journal in spring,

New data collection methods promise low cost techniques. We are employing both self-guided and interviewer formats to obtain specific information on location, association, and type of 'attachment to place' values. Thus far, returns indicate that the self-guided approach requires few resources to implement but appears to yield limited detail, while the active approach requires greater commitment by both federal managers and public but provides more detailed data. For the self-guided approach, we prepared 11"x 17" generalized maps of the study area and a brief set of instructions for identifying areas of importance and describing the values associated with these places. We distributed the maps with self-addressed, stamped return envelopes to residents attending the public collaborative planning meetings. The active collection approach uses an improved interview format and focuses on the sample population that we found produced the best information during the first round of interviews: key informants. We will develop a comparison of data collection approaches and include this with our study methods as a guide for managers.

Field verification is on going, incorporated into collaborative planning meetings. All useable data - from initial interviews, self-guided maps, and new interviews - are being digitized and entered into a GIS database as they are received. Results and interpretations are presented at each collaborative planning meeting, providing for iterative and continuing verification of the dataset. The GIS dataset of social values will be complete by mid-October and transmitted to the Bitterroot National Forest.

Functional linkage of data to the ecological model will occur Fall 2005, guided by the conceptual model. Data collection will be complete by the end of September. Qualitative analysis has begun to develop a hierarchy of attachments and to identify associated ecological conditions. Association with ecological conditions tracked in SIMPPLLE and MAGIS, guided by the revised conceptual model, is scheduled for early fall, 2005. The resulting table of the functional relationships between likely fuels reduction activities and their affect on major classes of attachment will be incorporated into the final results and management guide.

Current data collection will assist in determining effects of treatments. Social attachments will be analyzed to determine both social and ecological attributes. Ecological attributes will be associated with physical data (topographic and vegetative), then tracked during SIMPPLLE and MAGIS runs for all treatment alternatives. Resulting ecological conditions will then be reconciled with social attributes to predict effect of treatment on social values and attachments. Resulting predictions will be qualitatively assessed during presentations to the collaborative planning meetings in late fall, 2005.

Issues/Concerns; changes in research objectives, methods, or products:

We expect to complete the project within budget, though our projected end date is now mid-spring 2006 instead of the original January 2006. The reason for this is two-fold: (1) our assumption that existing social data was sufficient proved incorrect; (2) efforts to retain a graduate student to collect necessary additional data took longer than expected. Data collection was initiated in June and will be complete by the end of September. Analysis has begun and will be completed in 2005.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Effects of fuels treatments and wildfire on understory species and fuels in the ponderosa pine zone of the Colorado Front Range

JFSP Project No.: 04-2-1-118

Project Location: Upper South Platte Watershed, Colorado

Principal Investigators: Paula Fornwalt, Merrill Kaufmann

Contact Information (Phone, e-mail): 970-498-2581; pfornwalt@fs.fed.us

Brief Description of Project:

This project is a holistic ecosystem evaluation of the changes in forest overstory and understory structure and fuel characteristics that result from restoration actions and wildfires. The objectives stem directly from the rapid increase in fuel treatments and the need to know that these treatments will succeed and be ecologically and socially acceptable over time. This project has two specific objectives:

1. *To assess the effects of restoration (mechanical thinning) and wildfire on understory species composition and surface fuels.* This includes (a) analyzing both monitoring data collected before and after mechanical fuels treatments in the Upper South Platte Watershed, and pre- and post-fire plot data in areas that burned at several severities in the Hayman fire, and (b) collecting new data to expand treatment evaluations and to facilitate comparisons with pre-existing data collected throughout the area.
2. *To evaluate the effects of restoration versus wildfire on forest overstory and understory structure, fuels, and long-term fire behavior characteristics.* Our objective here is to evaluate the relative effectiveness of restoration treatments and wildfire in achieving overall landscape restoration goals. This will yield insight into the potential of these two very different disturbances, one planned and one not, in meeting the short-term (i.e. 1-5 years) goals of land managers, with regard to overstory structure, understory species composition, and surface fuels, as well as long-term goals (25-50 years) for restoring features of sustainable landscapes. We will also use two models -- the Fire and Fuels Extension of the Forest Vegetation Simulator (FFE-FVS), and the Fire Area Simulator (FARSITE) -- to help answer questions about the effectiveness of thinning and the current fire regime (i.e. high severity fire) at mimicking the landscape processes that historically shaped the landscape (i.e. mixed-severity fire).

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research):

In 2004:

- 75 modified-Whittaker plots were established among 5 study areas.
- Overstory, understory, and fuels data were collected in each of the plots.
- Data management and preliminary data analysis were performed.

In 2005:

- All plots were re-visited and re-sampled.
- Data analysis and modeling will begin in the fall 2005.

In 2006:

- Data analysis and modeling will continue.
- Meetings with relevant land managers will be conducted to discuss the implications of the research findings.
- Preparation of deliverables will begin.

In 2007:

- All deliverables will be completed.
- Technology transfer will continue with land managers.

Implications for the research:

This research addresses the task statement of the 2004-2 Announcement For Proposals ("Proposals are sought to directly address locally important knowledge or data gaps associated with planning and implementation of wildland fire, fuels treatment, or post-fire treatment actions..."). Agency administrators on the Pike/ San Isabel National Forests have clearly expressed the need for this kind of data as both restoration and wildfire increasingly alter the structure of Front Range ponderosa pine forests.

Both land managers and the scientific community will benefit from the results of this study. Interactions with the Upper South Platte Restoration Project and the Front Range Fuels Treatment Partnership will extend these results over many areas of the Colorado Front Range as managers continue the adaptive management process. The findings will be published as several peer-reviewed papers in accredited journals.

Issues/Concerns; changes in research objectives, methods, or products:

None to date.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Digital Photo Series

JFSP Project No.: 04-4-1-02

Project Location: USFS, Pacific Wildland Fire Sciences Laboratory, Seattle, WA

Principal Investigators: Clinton S. Wright, Robert E. Vihnanek, and Roger D. Ottmar

Contact Information (Phone, e-mail): Phone: (206) 732-7827 E-mail: cwright@fs.fed.us

Brief Description of Project:

The Digital Photo Series is a user-friendly web interface to a database that houses the data and images contained within the Natural Fuels Photo Series. The Digital Photo Series will include data that were collected, but not included in the original books because of publication limitations, as well as added functionality for fire and fuels planners and scientists (e.g., browsing, querying, reports, and output formatted to interface with other fire management tools and software). The Digital Photo Series is a tool to more easily and effectively use the comprehensive fuels data sets available for numerous ecosystems for strategic planning and analysis, and for implementation of field projects.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The system design and engineering phase and a user survey have been completed. The user survey identified potential user preferences and technology requirements, and also solicited thoughts and ideas for new and innovative uses of photo series data and images. The survey results have been compiled and are helping shape and refine the ongoing development process.
- A complex, relational database (using MS Access and MySQL) that incorporates all of the data available in the printed versions of the Natural Fuels Photo Series has been completed. Refinements of this database are ongoing and additional data elements not included in print are being added. Several projects, including LANDFIRE, FVS-FFE, and FIRETEC, have requested to use this database prior to completion of the project.
- Conversion of film images to digital format has begun and is ~35% complete.
- The initial data and image display programming has been completed and the data search and query step is well into the development and programming process. Programming to support reporting and exporting has not yet been started, but a contract has been initiated to facilitate completion of these steps.
- Formal testing and documentation has not yet been started, although technology transfer has begun. Information about the DPS appears in a posting on the FIREHouse website (<http://depts.washington.edu/nwfire/project.php?projectID=384#5>).

Issues/Concerns; changes in research objectives, methods, or products:

- After careful consideration, the decision was made to develop the application in a web-browser environment (using a browser and a combination of .php, .html, .xml, .css and .sql technologies) allowing it to be served through the internet and also stand alone with the inclusion of a mini-server as part of the 'application.' This is a subtle departure from the original proposal (which called for a stand-alone application that was also available on the internet), but one that will make the data and images of the Natural Fuels Photo Series available to a much wider audience.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Development of training resources for application of BlueSkyRAINS in Smoke Management and Fire Operations

JFSP Project No.: 04-4-1-04

Project Location: Seattle, WA

Principal Investigators: Jeanne Hoadley*, Sue Ferguson, Susan O'Neill, Rob Wilson

Contact Information (Phone, e-mail): (206)732-7867, jhoadley@fs.fed.us

Brief Description of Project: Development of training resources to facilitate application of the BlueSky modeling framework and its Rapid Access Information System (RAINS) to Smoke and Fire Management and Operations

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Contractor has been hired to design web based tutorial and on-line help
- Initial meeting to review tasks for tutorial and help development held August 16, 2005
- BlueSky was presented at RX-410 in three Forest Service regions- lesson plan will be finalized this fall
- Draft of printed user's guide is complete and in review with collaborators
- Workshop was held in June to begin testing of tutorial content

Issues/Concerns; changes in research objectives, methods, or products:

Everything is on track for on time completion of all deliverables for this project.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Publication of literature synthesis entitled “Effects of Fire on Nonnative Invasive Plants” as 6th volume in the General Technical Report series *Wildland Fire in Ecosystems* (“Rainbow series”)

JFSP Project No.: 04-4-1-08

Project Location: Fire Sciences Laboratory, Missoula, MT

Principal Investigators: Jane Kapler Smith, Steve Sutherland, Matthew L. Brooks, Alison Dibble, Janet K. Clark

Contact Information (Phone, e-mail): 406-329-4805, jsmith09@fs.fed.us

Brief Description of Project: This project is producing a General Technical Report in the *Wildland Fire in Ecosystems* (“Rainbow”) Series to synthesize science-based information on relationships between fire and nonnative invasive plant species. The report has 3 sections:

1. fundamental concepts governing relationships between fire and nonnative invasive species (effects of fire on invasives, invasives’ effects on fire regimes, fire use to control invasives)
2. regional analyses of fire-invasive issues
3. general management applications, including effects of fire suppression and fuel management, monitoring, and integration with other management programs

When completed, this report will be distributed systematically to wildland managers and people who offer training to managers. A CD-ROM will be produced containing all 6 Rainbow Series reports, plus a PowerPoint introduction and worksheet, and delivered to those who teach managers about fire and invasive plants.

Status Report:

Deliverable 1: General Technical Report entitled “Fire and Invasive Plant Species”—progress as of 8/22/05:

- Total chapters planned: 15—4 in Section 1, 7 in Section 2, 4 in Section 3
- Chapters in peer review: 1
- Chapters in review among technical editors (Smith, Brooks, Sutherland, Zouhar): 4
- Chapters in initial review but “a lot of work left”: 5
- Chapters not yet drafted: 5. Note that four of these are in Section 3 and will be written after other chapters are drafted; content will depend on how management issues are covered in earlier chapters.

Deliverable 2: CD-ROM, including PowerPoint and worksheet, for educators teaching managers and students about fire effects and management of invasive plants

- Will be completed after GTR is in press

Issues/Concerns; changes in research objectives, methods, or products:

Issues: The project is about 6 months behind schedule for 3 reasons: One product anticipated from the Center for Invasive Plant Management (CIPM) was written as an annotated bibliography rather than a synthesis so it could not be used in this report; one product from CIPM is still not complete; and one author backed out of writing a chapter, which then had to be reassigned. Publication is now anticipated in fall '06 rather than spring '06.

Additional product: Publication date will be very close to the dates of the 3rd International Fire Ecology & Management Congress (Nov. 13-17, 2006) in San Diego. The editorial team has proposed a special session at the conference to feature talks on the report.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Training Package for Land Management Tools Sponsored by the JFSP: Photo Series, FCCS, Consume 3.0, and FEPS.

JFSP Project No.: 04-4-1-19

Project Location: Pacific Wildland Fire Sciences Laboratory, Seattle, Washington

Principal Investigators: Roger D. Ottmar and Ellen Eberhardt

Contact Information (Phone, e-mail): Phone: (206) 732-7826; rottmar@fs.fed.us

Brief Description of Project: Knowing the amount of biomass and other fuel characteristics, and potential fuel consumption and emissions production is becoming increasingly important for making informed decisions on the use of prescribed fire, wildfires and wildland fire use fires. Consequently, the Joint Fire Science Program funded the development of 4 fuels and fire management tools that included the Natural Fuels Photo Series, Consume 3.0, Fuel Characteristic Classification System (FCCS), and the Fire Emissions Production Simulator (FEPS). Since these tools work in tandem with each other, a web-based tutorial technology transfer package and a stand alone instructor's guide and student workbook on how to use these products needs to be completed.

The objective of this research proposal is to develop an on-line tutorial package that will provide land managers with the ability to use the Natural Fuels Photo Series, Consume, FCCS, and FEPS in their everyday prescribed fire and wildfire planning. A self-guided tutorial along with an instructor's guide and student workbook will be the science delivery product. It is anticipated that the tutorial will be downloadable from each package website or, in certain cases, incorporated directly into the software package. The instructor's guide and student workbook will allow agencies can initiate a training program or add to an existing training curriculum.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Science Delivery:
1. An informal survey has been completed to determine the science delivery package most suitable for development.
 2. Contracted with Northwest Alliance for Computational Science and Engineering to develop the 4 tutorials.
 3. Provided contractor with software, user manuals, training packages, and photo series for each of the tools.
 4. Completed 4 prototype tutorials.
 5. Review and final release with instruction guide is expected March 1, 2006.

- Applications:
1. A draft of the tutorials are expected to be completed by November 2005 and is expected to be used for testing at the first regional workshop to train the trainers on how to use the FCCS, Consume 3.0, and photo series.

- Management:
1. The tutorial and instructional package will allow individuals to learn Consume 3.0, FCCS, and the photo series on their own. The instructional guides will allow this same information to be incorporated into existing training.

Issues/Concerns; changes in research objectives, methods, or products: None. An extension was requested that will allow the project to be completed with a more formal review and implementation.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Bringing the Fire Effects Information System up-to-date and Improving Service to Land Managers

JFSP Project No.: 04-S-03

Project Location: Fire Sciences Laboratory, Missoula, MT

Principal Investigators: Jane Kapler Smith, Melanie Miller

Contact Information (Phone, e-mail): 406-329-4805, jsmith09@fs.fed.us

Brief Description of Project: The Fire Effects Information System (FEIS, at www.fs.fed.us/database/feis) contains reviews of the scientific literature on biology and fire for 1,000-plus plant and animal species in North America. FEIS began in 1985, and work on the first 1,000 species was completed in the mid-1990s. While writing after 1996 was minimal, the scientific literature on fire ecology, fire regimes, and fire effects continued to increase. FEIS was unable to synthesize most current research for managers or respond to managers' requests for new species reviews. This task is synthesizing new information on 200 species into FEIS. The species to be reviewed were selected by an Advisory Committee representing all geographic areas in the U.S.

Status Report:

Progress:

- FEIS Advisory Committee established (Summer 2004)
- Term staff hired and trained: 5 writers, 1 library assistant, 1 library technician (staffing completed Feb. 2005)
- 562 species nominated by Advisory Committee and others, 209 selected (selection completed Feb. 2005); 200 or more will be completed under this task
- About half of selected species are "new" to FEIS and half "old" but requiring new information synthesis
- Selected species include 171 plant species and 38 animals
- Currently reviews of 16 species are complete and on the Internet, 38 are in process

Issues/Concerns; changes in research objectives, methods, or products:

No issues or concerns. No changes in objectives or methods.

A new FEIS product, the "Research Project Summary" (RPS), has been developed with guidance from the FEIS Advisory Committee. The RPS file structure enables us to provide timely summaries of published fire effects research and link each RPS to numerous FEIS species reviews without revising every review linked. The new file structure also makes information from RPS files available for species not covered by a FEIS species review. Four RPSs are currently in preparation.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Comparison of Live Fuel Moisture Sampling Methods for Big Sagebrush (*Artemisia tridentata* spp.) in Utah

JFSP Project No.: 05-2-1-70

Project Location: 45 miles southwest of Salt Lake City

Principal Investigators: Philip N. Omi

Contact Information (Phone, e-mail): 707-824-6852 / phil@cnr.colostate.edu

Brief Description of Project:

The overall objective of this project is to increase the accuracy and comparability of live fuel moisture (LFM) samples collected for fire management purposes. This research will help understand how variations in data collection affect LFM values in low elevation big sagebrush. LFM field samples using several commonly employed methods have been collected to test differences in LFM resulting from varying sampling techniques. A statistical analysis will indicate which methods provide differences and similarities in resultant LFM values. These results will be evaluated in terms of timing (season) of the sampling and final recommendations will be made as to the most appropriate LFM sampling methods for big sagebrush.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- **October 17-20, 2005:**
Preliminary results presented at the poster session at Tall Timbers Fire Ecology conference in Bartlesville, Oklahoma.
- Additional deliverables include: revisions to the Utah fuel moisture collection guide (and training field personnel); submission of manuscript to refereed journals and/or management publications; presentations of results and recommendations at conferences/workshops; Master's thesis.

Issues/Concerns; changes in research objectives, methods, or products:

- After preliminary sampling and analyzing previously collected data from the same area, sample size was increased from 4 to 8.
- The first round of samples was collected over two days due to the extensive collection time. The second round was collected in one day due to increased personnel performing the collection.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Why Burning Brings Beetles: Fire-Bark Beetle Interactions

JFSP Project No.: 05-2-1-92

Project Location: Crater Lake National Park

Principal Investigators: James K. Agee, Daniel Perrakis

Contact Information (Phone, e-mail): jagee@u.washington.edu

Brief Description of Project: Old-growth ponderosa pine have been observed across the West to be dying in greater than expected numbers from the reintroduction of prescribed fire, even with the fires are within expected intensity limits. Mortality is via bark beetles 2-4 years after burning. These trees are important forest structural elements that are important to retain as live trees after fuel treatments. Previous work hinted that season of burning may be responsible, and a previous demonstration project in our area documented mortality in the first two years after burning. This project will carry forward the measurement activity on over 1800 large ponderosa pines, investigate beetle defenses via resin flow measurements, and couple resin flow and quality data to actual mortality. Experimental treatment of trees via burning and artificial pruning and root damage, with associated resin measurements, will attempt to understand these effects as they occur. Results will be linked to management practices and disseminated through a variety of technology transfer outlets.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

We received approval of funding in June 2005, and are in the process of negotiating a JVA with the USDA Forest Service. As of mid-August, we have received no authorization to spend funds on the project, so have little to report at this time. We have completed the treatments of pruning, root trenching, and burning, and have installed dendrometers and have been making oleoresin flow measurements, but have no results to report at this time.

Issues/Concerns; changes in research objectives, methods, or products:

We anticipate everything to go smoothly. Delays in passing money between institutions are normal, and we expect to have budget authority and a budget number soon.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Biomass Reduction and Prescribed Fire Management on a First-Order Watershed in the Southeastern Wildland-Urban Interface.

JFSP Project No.: 05-2-1-106

Project Location: Santee Experimental Forest, South Carolina

Principal Investigators: C. Trettin, D. Amatya, M. Coleman, J. Kilgo, L. White

Contact Information (Phone, e-mail): 843-769-7002, ctrettin@fs.fed.us

Brief Description of Project:

Given the density of current stands on coastal plain forests, mechanical treatment is necessary prior to re-introduction of fire. Under HFRA, Francis Marion National Forest (FMNF) personnel are currently establishing stewardship contracts to reduce fuel load and disease susceptibility, improve wildlife habitat, and offset increasing coal prices with thinning treatments. They estimate that over 30,000 acres will need treatment on the FMNF in the next five to ten years. Another benefit of the thinning treatment is that it can provide biomass as a feedstock for energy production. Understanding the environmental effects of these treatments is essential to wide-spread implementation of these prescriptions. This study addresses questions associated with sustainable productivity, water quality, vegetation, fuels, and life habitat and T&E species. Another important objective is to provide a comprehensive demonstration area that can be used for training and demonstration purposes. The study and demonstration is being conducted at the watershed scale, employing two first-order watersheds within the wildland-urban interface (WUI) that have been monitored since the late 1960s.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The NEPA documentation and review should be completed by September, 30 2005. Completion of the NEPA review will allow the development of the thinning contract, with the thinning scheduled for spring, 2006. Accordingly, the pre-treatment planning activities are proceeding on schedule.
- The treatment plan has been revised to include an additional area where the thinning and burn treatments can be partitioned. Accordingly, the entire treatment first-order watershed will be managed as proposed, and an adjoining area will be used for plots representing the full factorial of the 2x2 treatment matrix.
- Provisions for pre-treatment sampling and analyses will be completed in September, 2005, with field activities scheduled through March, 2006.
- An implementation plan for the science delivery aspects of the project will be completed in December, 2005. We anticipate expanding the number of collaborators to enhance capabilities for utilizing this project for public education purposes.

Issues/Concerns; changes in research objectives, methods, or products:

- None, at this point.
-

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2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Burn severity mapping using simulation modeling and satellite imagery

JFSP Project No.: 05-1-1-12

Project Location: Missoula, MT

Principal Investigators: Eva Karau, Robert Keane

Contact Information (Phone, e-mail): 406-829-6950, ekarau@fs.fed.us

Brief Description of Project:

To efficiently allocate rehabilitation resources to fire-prone areas under their custody, land managers must be able to efficiently assess fire effects. Satellite image-based burn severity maps can be quickly generated to provide a landscape view of relative fire severity, while fire effects simulation models provide biotic context to the effects of the burn. Using ground reference data that we will collect in areas that burn in 2005 and 2006, along with existing field, image and GIS data, we will evaluate the utility of Δ NBR-based satellite image methodology and the FIREHARM fire effects model. We will develop a set of tools and procedures for running the model and generating burn severity images. Additionally, we will hold informational workshops that will teach managers how to use these tools. Our goal is to demonstrate that image and model-derived burn mapping methodologies, used individually or in tandem, have the potential to greatly improve our ability to manage the effects of wildfires, on a national level.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Currently we are investigating and demonstrating Δ NBR and FIREHARM-based burn severity mapping tools using data from previous fires. This involves processing satellite imagery, organizing field data and preparing input data for FIREHARM simulations. Next we will begin the analysis phase, where we will compare model and image maps with field data and with each other. If a fire occurs in 2005 or 2006 (the fire must meet certain geographic criteria), we will incorporate it as a new study area.

Proposed deliverables:

- ☐ Procedures Guide - We will provide a set of instructions that will enable managers to create maps of both satellite and modeled burn severity overnight. Guide preparation will begin in FY07.
- ☐ Journal Article - Results from our demonstration and evaluation of model and image-based fire effects mapping techniques will be published in a peer-reviewed journal. Article preparation will begin in FY07.
- ☐ Workshops -We will host two 2-day workshops to teach managers how to use satellite imagery and the FIREHARM model to quickly create burn severity maps for their landscapes. Workshops will be held in 2007 and 2008.
- ☐ Technology Transfer - The procedures guide, FIREHARM program executable, and journal article will be published on CD, and will also be available for download from various websites. Model versions and updates will also be available through FRAMES (Fire Research and Management Exchange System).

Issues/Concerns; changes in research objectives, methods, or products:

As yet, this fire season has not produced a suitable test area for our study. We need a fire that has burned at least 5,000 acres through varied vegetation types (i.e. both forest and grass) in either MRLC zone 16 or 19. When a suitable fire occurs, we will use it as a new study area and collect fire effects field data. Until then, we will continue to analyze data from the Cooney Ridge and Mineral-Primm fires (Montana, 2003) and the Sanford fire (Utah, 2002).

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Evaluating the Efficacy and Ecological Impacts of BAER Slope and Stabilization Treatments on the Pot Peak/Deep Harbor Wildfire Complex

JFSP Project No.: 05-1-2-02

Project Location: Chelan, WA (Okanogan-Wenatchee National Forest)

Principal Investigators: David W. Peterson, Richy J. Harrod

Contact Information (Phone, e-mail): Peterson: 509-664-1727, davepeterson@fs.fed.us;
Harrod: 509-664-9331, rharrod@fs.fed.us

Brief Description of Project: The purpose of this project is to test the efficacy of seeding and fertilization treatments used for slope stabilization following high severity wildfires in the inland Pacific Northwest. We are using an experimental approach (randomized block design with replication within blocks), with seeding and fertilization treatments applied in factorial combination (4 seeding treatments X 3 fertilization treatments X 8 replicates = 96 plots per site) at multiple sites. We are assessing treatment effects on plant cover (total and native), plant diversity, and plant community composition during the first two growing seasons following fire. Our primary goal is to identify treatments that promote high plant cover during the first two years following fire, while minimizing detrimental impacts on the recovery and species diversity of native plant communities.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): Accomplishments and deliverables during the first six months of the study include:

- Installed plots and applied treatments at eight sites within the Pot Peak fire area.
- Surveyed first year plant cover and species composition at all Pot Peak sites.
- Collected soil samples for laboratory analysis of soil C and nutrient status.
- Developed a draft monitoring protocol for assessing efficacy of operational slope stabilization treatments.
- Surveyed third year plant cover and composition from a similar pilot study on the nearby Deer Point fire.
- Scheduled a poster presentation of Deer Point pilot study results at Tall Timber Fire Ecology Conference in Oklahoma (October 2005).

Issues/Concerns; changes in research objectives, methods, or products:

- Conflicts with operational treatments, supply problems, and logistical concerns led us to replace the straw mulching treatment with an additional fertilization treatment (higher application rate). This change was made following consultations with District and Forest managers (and with their concurrence). Mulch depths were instead measured on treatment plots for potential use as a continuous covariate in assessing effects on plant cover, diversity, and weed abundance.
- In September, we plan to add four additional sites on the Dirtyface Fire (2005) near Leavenworth, WA. The additional sites will allow us to test treatment effects in new settings and apply seeding treatments in the fall, prior to autumn rains. Fall sowing is expected to improve performance of the seeding treatments.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Management Options to Control Exotic Invasive Plant Species in Association with Fuel Reduction Treatments in a Wildland Urban Interface.

JFSP Project No.: 05-2-1-05

Project Location: Eastern Washington Cascades, Cle Elum RD, Okanogan-Wenatchee NF

Principal Investigators: Becky K. Kerns and Viva Worthington

Contact Information (Phone, e-mail): Kerns: 541-750-7497; bkerns@fs.fed.us

Brief Description of Project:

Efforts across the west to reduce severe wildfires hazard by thinning and prescribed burning are expected to produce long-term benefits. However, these treatments can introduce or spread exotic noxious weed species into forest ecosystems. It is a significant challenge for land managers to apply fuel reduction treatments in a manner that does not exacerbate existing weed and associated resource problems. This study compares management options for controlling weed establishment and spread within the Liberty WUI Fuel Reduction Project, located along the eastern slopes of the Cascades, Cle Elum Ranger District, Okanogan-Wenatchee National Forest. Planned fuel reduction activities will be conducted in an area that has been already been invaded by noxious weeds such as diffuse and meadow knapweed (*Centaurea diffusa*, *Centaurea pratensis*). We will compare the efficacy and cost effectiveness of herbicide, hot foam, and native seeding experimental treatments to suppress and control weeds prior to and after fuel reduction activities and to enhance native plant diversity and community resilience. We will also examine the effect of fuel reduction activities and weed suppression treatments on plant community structure.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Preliminary field reconnaissance is in progress and this study is currently in the establishment stage.
- Funds have not yet been received (as of August 25th, 2005)

Issues/Concerns; changes in research objectives, methods, or products:

Because this project will not be funded in late in the 2005 field season, we will most likely extend this project for another fiscal year (e.g. FY06 – FY08). Other than this, everything is on track. Because district activities are also delayed, this will not pose a problem in terms of pretreatment data collection, research objectives, methods or products.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Post-Fire Studies Supporting Computer-Assisted Management of Fire and Fuels during a Regime of Changing Climate in the Alaskan Boreal Forest

JFSP Project No.: 05-2-1-07

Project Location: Alaska

Principal Investigators: T. Scott Rupp

Contact Information (Phone, e-mail): 907-474-7535, scott.rupp@uaf.edu

Brief Description of Project: Our goal is to provide a scale-integrative planning and monitoring tool for wildland fuels and fire management that is specifically tailored to Alaska's ecological conditions and that addresses particular threats (notably climate change) to its natural fire regimes. To accomplish this, we will analyze the processes that determine burn severity in the boreal forest and quantify the impacts of climate change on fire regimes and forest age structures. These results will be used to further develop the Boreal ALFRESCO computer model and to extend the technology transfer process initiated by our 2002 JFSP project. Boreal ALFRESCO provides a much-needed tool for synthesizing multi-disciplinary management issues as well as an operational tool in preparing environmental assessments for fuels and fire management. Boreal ALFRESCO outputs will also assist managers in their FRCC efforts by providing the natural reference landscapes and estimates of fire frequency needed by VDDT models. In the longer term, this project will provide valuable information and methodology for the LANDFIRE project in Alaska. Overall, this project will increase our understanding of vegetation and fuel dynamics during a regime of changing climate and improve our ability to manage this vast, dynamic landscape.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements): We initiated this project in June 2005.

Our first field season has focused on quantifying the relationship between the age of black spruce fuel types and burn severity. This work has included:

- Collaborating with USFWS, NPS, and BLM Alaska Fire Service to obtain extensive samples from 2004 burns throughout interior Alaska.
- Collaborating with other University researchers studying the record 2004-fire season. These efforts include working closely with 2005 JFSP PI's Johnstone and Hollingsworth and a 2005 NASA funded study with PI Kasischke.
- 750+ samples have been collected from 9 different 2004 burns. Sampling will continue through September 2005 and we anticipate collecting an additional 250 samples by the close of the field season.

Model development has continued as we strive to complete technology transfer of our 2002 JFSP project and establish required overlap with our new 2005 JFSP project. This work has included:

- Final implementation of human ignition and suppression effects on landscape dynamics in the Boreal ALFRESCO model.
- User-friendly software version and documentation. This work will culminate with a workshop on October 5, 2005 where the software will be transferred to all interested

federal, state, and private fire managers. We plan to use this meeting to establish interactions with key personnel for our 2005 JFSP project.

- Collaboration with the national FRCC efforts (through Wendel Hann) focusing on Alaska implementation and application.
- Development of PowerPoint presentation and field trip stop for the JFSP board visit to Fairbanks on September 12, 2005.

Issues/Concerns; changes in research objectives, methods, or products: None at this time.

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: Masticated fuel beds: custom fuel models, fire behavior, and fire effects

JFSP Project No.: 05-2-1-20

Project Location: Northern California and Southern Oregon

Principal Investigators: Eric Knapp, Matt Busse, J. Morgan Varner, and Carl Skinner

Contact Information (Phone, e-mail): (530) 226-2555

Brief Description of Project:

Mastication is an increasingly popular means of treating ladder fuels to reduce wildfire hazard, yet little is known about how masticated fuels burn. This project will address three aspects of fire behavior and fire effects: 1.) Fuel bed parameters for use in fire behavior and effects models will be quantified at ten sites where fuels have been masticated in the foothill and mountain regions of California and southern Oregon. 2.) Replicated prescribed burns will be conducted at two of these sites in order to develop and test custom fuel models and to evaluate fire effects on trees. 3.) Small laboratory burns will be conducted using constructed masticated fuel beds to test differences in above- and below-ground heating among fuel bed types, fuel bed compaction levels, and soil moisture levels. Products generated from this research will assist managers in estimating fire hazard reduction and developing strategies for prescribed burning that minimize tree mortality and adverse soil heating impacts.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Measurements of fuel loading and fuel bed depth have been completed at one of the ten sites (Challenge Experimental Forest, Plumas NF, CA).
- Four prescribed burns in masticated fuels were completed in May and June 2005 at this same site. Fire behavior (flame length, rate of spread, residence time) was quantified for backing fires during the burns. Fuel moisture and soil moisture levels were also determined.
- Thermocouples were placed at the duff/mineral soil boundary and at 5cm and 10cm depths in the mineral soil at nearly 75 locations within the burn units. Even though temperatures at the soil surface were sometimes high (max. = 701 C°), surprisingly little heat penetrated far into the soil. The average heat experienced at the 5cm depth was only 28 C° (range = 18-66 C°), and no significant heating was observed at the 10cm depth. Soil heating was likely buffered by the high soil and duff moisture levels. Burns under such conditions may allow managers to avoid soil damage while treating such fuel beds with prescribed fire.
- Fire damage measurements (crown scorch height, bole char height, percentage of bole circumference charred) on trees within the masticated burn units were completed in August, 2005.
- We have met with managers at three additional sites to be sampled and finalized the locations where data will be collected. We are also talking with the California Department of Forestry about conducting prescribed burns at the second burn site during the fall months under lower soil moisture conditions. This will allow us to compare soil heating with prescribed burning in masticated fuels under varying soil

moisture regimes in the field. We will visit with managers at the remaining sites in the fall and winter of 2005/2006.

- Controlled laboratory experiments to evaluate the impact of soil moisture and soil type on soil heating under burns in constructed masticated fuel beds are underway.
- A graduate student at Humboldt State University has been recruited and brought on board. This student (Jeffrey Kane) who will work on additional laboratory burning experiments as part of his Masters research.

Issues/Concerns; changes in research objectives, methods, or products:

We expanded the fire effects component of the research to include a field fuel removal treatment. Fuels were removed in a 50cm ring around the stem base of a randomly chosen subset of trees in order to separate the influence of heat damage to roots from heat damage/char to the tree boles on mortality rate. We also expanded the field monitoring of soil heating, employing extensive thermocouple arrays during the prescribed burns. These additions are at no cost to JFSP and were completed with added contributions of time and equipment by the principal investigators and permanent staff.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fuel reduction and restoration of pine/hardwood ecosystems severely impacted by the recent southern pine beetle (*Dendroctonus frontalis*) epidemic in the southern Appalachians

JFSP Project No.: 05-2-1-29

Project Location: Coweeta Hydrologic Laboratory, Southern Research Station, USFS, Otto, NC – western North Carolina

Principal Investigators: Drs. James M. Vose and Katherine J. Elliott

Contact Information (Phone, e-mail): 828-524-2128; jvose@fs.fed.us

Brief Description of Project: The objectives of this project are: (1) to compare and quantify fuel load reduction methods (pine overstory felling, material left on site followed by prescribed fire; prescribed fire only; and no treatment) in pine/hardwood forests heavily impacted by southern pine beetle induced tree mortality, and (2) to evaluate the effects of further restoration treatments including planting yellow pine and seeding native grasses on ecosystem structure and function in these pine-hardwood ecosystems in the southern Appalachian region.

Status Report: We have made progress on our project which was just funded in May, 2005. Working with the Cherokee National Forest in Tennessee, we have located 8 sites in southeastern Tennessee that are scheduled for fuel reduction and restoration treatments. All of the pine/hardwood sites were selected because they have been heavily impacted by southern pine beetle induced tree mortality. Permanent plots were established to measure pre- and post-treatment vegetation, soil and soil solution chemistry, and carbon and nutrient pools on all eight sites. We have completed our first pre-treatment measurement of nitrogen mineralization using the *in situ* covered-core incubation method. Soil solution lysimeters were installed at 30 and 60 cm soil depth at each of the four plots per site (burn and reference). Lysimeters will be sampled weekly, and soil solution analyzed for total N, P, and C, and inorganic N, PO₄, and pH. Pre-treatment vegetation (overstory, understory, and herbaceous layer) has been measured on all eight sites. We will sample forest floor and soil in November and December 2005, before the scheduled fire treatments in Feb-March 2006.

Issues/Concerns affecting the project: The pre-treatment sampling is progressing and on schedule. No results have been presented or published at this early date.

2005 JFSP Principal Investigator Workshop

Project Progress Report

05-2-1-30

Project Title: Red Mountain Mastication Study

JFSP Project No.: (2005-02-local needs)

Project Location: Sequoia National Forest, Greenhorn Ranger District

Principal Investigators: JoAnn Fites

Contact Information (Phone, e-mail): 530-478-6151, jfites@fs.fed.us

Brief Description of Project:

The purpose of the project is to compare and quantify the effects of several variations of mastication and burn treatments on fuel conditions, potential fire behavior and tree mortality. The study site is in a ponderosa pine plantation on the Sequoia National Forest that represents conditions found throughout ponderosa pine plantations in much of California. The project includes a formal experimental design with replicated randomized blocks. The treatments that will be compared are: mastication alone, mastication and prescribed burning, mastication with pull-back of material from trees and burning and a control. Response variables include: fuel loading and configuration, tree mortality, and fire behavior during prescribed burns (soil and surface temperature, rate of spread, intensity and fire type).

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- The experimental blocks and pre-treatment sampling have been completed.
- Mastication treatment is scheduled to begin in the study area on October 1, 2005, and is expected to be complete prior to the onset of fall/winter precipitation.
- A website is under construction, and will be completed and updated by the end of September, 2005.

Issues/Concerns; changes in research objectives, methods, or products:

None

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Fuel treatments and forest health: A film and interactive DVD

JFSP Project No.: 05-4-1-10

Project Location: Teakettle Experimental Forest

Principal Investigators: Malcolm North

Contact Information (Phone, e-mail): 530-754-7398, mpnorth@fs.fed.us

Brief Description of Project: Communication between scientists and fuels managers has been limited because research results often only appear in a diverse array of journals making it difficult to locate applied information relevant to particular fuels conditions. In theory the internet could bridge this divide, but searches often produce a mass of unfiltered technical information without clear local relevance. Manager's need a base information platform with an intuitive organization from which to search the internet. This proposal seeks funding to use a new technology, interactive DVD, to gain the user's interest, provide a common information portal and a tool for flexible information acquisition. Interactive DVD provides a film, special features for more in-depth information, and an updating website organized as a search platform for targeted information gathering. The film would build on the Teakettle Experiment's existing outreach and provide information about the different effects of prescribed fire and mechanical thinning on forest ecosystems. When the DVD is inserted in a computer or player it produces a website that allows viewers to play the movie or the special features, search a library of pdfs or link to information that is visually and thematically organized. Current technology would allow the user to click on the apparent website (actually on the DVD) and that would launch the connection to the Internet seamlessly moving from the DVD to websites with more in-depth information. At present much of the fuels treatment literature is dispersed in scientific journals or at disparate individual websites making it difficult to locate, filter and explore. We believe this new technology can help close the information gap between managers, scientists and the public.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

The current project referenced above is a continuation of JFS 01-3-1-05 "Demonstrating the ecological effects of mechanical thinning and prescribed fire on mixed-conifer forests". That project completed outreach products include 2 powerpoint presentations on the results of the Teakettle Experiment: The Teakettle Experiment: A Brief Overview and Summary. And The Teakettle Experiment: Fire and Thinning Effects on Mixed-Conifer Ecosystems. These have been distributed to interested managers and can be downloaded from the Teakettle website publications page <http://teakettle.ucdavis.edu/>

The film and DVD project has completed the first of two film shoots at the Teakettle Experimental Forest (2nd one is August 29-Sept. 1). The script is available at the website listed above. The introduction, main and special feature (seven 3-5 minute) films will be completed in November. The DVD and website will be built November 2005-April 2006. Final DVD roll out should be May 2005.

Issues/Concerns; changes in research objectives, methods, or products:

None, project is on schedule and within budget.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: Field Training Workshops for Demonstrating the Use of the JFSP-Sponsored Photo Series and Fuel Characteristic Classification System

JFSP Project No.: 05-4-1-14

Project Location: Pacific Wildland Fire Sciences Laboratory, Seattle, Washington

Principal Investigators: Roger D. Ottmar, Ellen Eberhardt, and Robert Vihnanek

Contact Information (Phone, e-mail): Phone: (206) 732-7826; rottmar@fs.fed.us

Brief Description of Project: Knowledge of the amount of biomass and other fuel characteristics is becoming increasingly important for making informed decisions on the use of prescribed fire, wildfires, and wildland fire use fires. Consequently the Joint Fire Science Program funded the development of fuels characterization tools that included the Natural Fuels Photo Series and Fuel Characteristic Classification System (FCCS). Both projects and deliverables are completed and it is time to demonstrate use of these products in a field application workshop format.

The objective of this research proposal is to conduct six, 3-day regional train the trainer workshops (Alaska, Pacific Northwest, Southwest, Southeast, Midwest/Northeast, and Hawaii) that will bring land managers together and focus on demonstrating the field use of the Photo Series and the Fuel Characteristic Classification System. Each workshop will request approximately 10-15 land managers to attend. The workshop will demonstrate, and expect the user to adequately demonstrate, how to use the photo series by visiting several field sites that will have been ground inventoried for the workshop and used for evaluating the participants' abilities. The workshop will also demonstrate how to use the Fuel Characteristic Classification System and how the FCCS national fuelbed parameters compare to real fuels in the field. In addition, the participants will learn how to use the FCCS system to select and customize fuelbeds, calculate fuel characteristics and fire potentials, apply those attributes to the landscape, and use those attributes to assess the landscape for fuel treatment prioritization and fire hazard analysis.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- Science Delivery:
1. Established tentative dates and locations for each workshop
 2. Contacted all sponsors and key contacts.
 3. Arranged facilities and logistics for the first workshop. Determined invitee list and drafted invitee letter.
 4. Completed workshop agenda and will be locating and inventorying units for the first workshop field day (Southeast workshop) in September, 2005

Table 1. Tentative dates and location for workshops.

Workshop	Location	Co-Sponsor/Contact	Tentative date
Southeast	Greenwood, GA	The Nature Conservancy/Kevin Heirs	November 15-17, 2005
Hawaii	Hilo, HI	State Forestry/Wayne Ching	April 18-20, 2006
Pacific Northwest	Redmond, OR	USDA Forest Service/Mike Gomez	May 16-19, 2006
Alaska	Fairbanks, AK	BLM,USFWS/Randi Jandt, Karen Murphy	August 2006
Pacific Southwest	Flagstaff, AZ	Rocky Mt Research Station/Carl Edminster	October 2006
North Central and Northeast	Grand Rapids, MN	USDA Forest Service, MIFC, North Central Station/Barbara Meyers, Andi Koontz	May 2007

Applications: 1. The regional workshops will demonstrate how to use the FCCS and photo series and assist in training individuals to teach the systems during regional and National training sessions. These workshops will assist in applying specific science delivery products supported by the Joint Fire Science Program

Management: 1. The workshops will provide the training and expertise to better assess fuelbeds and their characteristics for improved fire and fuels planning.

Issues/Concerns; changes in research objectives, methods, or products: None. The project is on time and within budget.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: FuelCalc: A tool for calculating wildland fuel quantities and qualities and supporting fuel management decisions

JFSP Project No.: 05-4-3-10

Project Location: Missoula, MT

Principal Investigators: Elizabeth Reinhardt, Joe Scott, Duncan Lutes

Contact Information (Phone, e-mail): 406 329-4670 ereinhardt@fs.fed.us

Brief Description of Project: A need exists for a simple computer program to determine surface and canopy fuel quantities (load, bulk density, depth) and qualities (fire behavior fuel model, fire-carrying fuel type) from a variety of fuel inventory data sources. In addition, fuel managers need help analyzing the potential effects of silvicultural treatments on surface and canopy fuels. Models of fire behavior and effects already exist, but the means to create inputs to those models is still lacking. Programs already exist to monitor fuel treatments over time, but not to simulate the potential effects of fuel treatment before implementation, so that managers can choose the best available treatment option. We propose to develop FuelCalc to carry out these calculations, incorporating both widely accepted methods for quantifying surface fuels and newly completed research funded by the JFSP for quantifying canopy fuels. FuelCalc supports fuel treatment decisions by simulating effects of a wide range of silvicultural treatments on surface and canopy fuels, and provides linkages to stand visualization, fire behavior and fire effects programs that rely on estimates of fuel characteristics. FuelCalc will deliver the best available fuel science information and research results in order to support fire science applications.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

- This project is still in the planning stages, and funding has not yet been received here at the unit.
- The following deliverables and tech transfer are planned within the two year project:

Deliverables

- **FuelCalc:** a tool to compute surface and canopy fuel loads and characteristics from inventory data, to support fuel treatment decisions by simulating effects of a wide range of silvicultural treatments on surface fuels and canopy fuels, and to provide linkages to stand visualization, fire behavior and fire effects programs that rely on estimates of fuel loads and qualities.
- **Batch mode:** A batch mode of FuelCalc will be developed that allows processing a list of stands without using the user interface. We have found this to be an important feature for large analysis projects.
- **Computer routines** that can be incorporated into other software, providing for consistency and simplifying programming of future analysis tools.

Technology Transfer

- **Web Page:** FuelCalc will be posted on a web page for downloading. The web page will also contain tutorials, documentation, and a registration form for an electronic mailing list.
- **Built in Help:** FuelCalc will have a self-contained help system similar to that in FOFEM 5 and NEXUS.

- Tutorials: Tutorials will be provided to show users how to use FuelCalc for a variety of tasks.
- Presentation of FuelCalc in a pre-conference workshop/training session.
- a lesson plan that will be posted for downloading (for example, see the FOFEM PowerPoint presentations posted on fire.org).

Issues/Concerns; changes in research objectives, methods, or products: None.

2005 JFSP Principal Investigator Workshop

Project Progress Report

Project Title: A Regional Experiment to Evaluate Effects of Fire and Fire Surrogate Treatments in the Sagebrush Biome

JFSP Project No.: 05-S-08

Project Location: USGS Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon

Principal Investigators: J.D. McIver, H. Barrett, M. Brunson, S. Bunting, J. Chambers, C. D'Antonio, P. Doescher, S. Karl, S. Knick, R. Miller, M. Pellant, F. Pierson, D. Pyke, K. Rollins, B. Roundy, G. Schupp, R. Tausch, D. Turner, M. Wisdom

Contact Information (Phone, e-mail): Phone: 541-529-5129, ext. 35; email: james.mciver@oregonstate.edu

Brief Description of Project:

This project will evaluate effects of fire and fire surrogate treatments that are designed to reduce fuel and to restore sagebrush communities of the Great Basin. The study has several features that make it an ideal management-research collaboration, because it will: 1) provide managers with improved information to restore ecological communities that is relevant across the 100+ million acres of the sagebrush biome; 2) match the temporal and spatial scales at which managers operate; 3) reduce management risk and uncertainty of catastrophic wildfire to the greatest degree possible; and 4) provide managers with information that would allow them to better understand tradeoffs inherent in the choice of management alternatives. The need for such an experiment is evidenced by the profound changes in fire regime experienced in the Great Basin in the past 150 years, coupled with the lack of information available to managers on the consequences of methods they might use to reduce fire risk or to restore more desirable plant communities and fire regimes.

Treatments include prescribed fire, mechanical, and herbicides. Treatments will be applied and tested across a wide variety of sites across the Great Basin, in sagebrush steppe communities that are being invaded by either woodland species or cheatgrass. The multi-site design will provide a much better understanding of the 'conditional' response to treatment.

The project is fully interdisciplinary, with ecological (fuels, vegetation, soils, hydrology, wildlife), economic, and socio-political components. The combined ecological, economic, and socio-political approach provides a practical focus on maintaining sustainable systems under multiple use management guidelines for public lands. This approach is especially important in circumstances where decisions regarding public lands today can reduce the probability of potentially irreversible losses that would affect human populations for generations.

Key deliverables include a 'Fuel's Guide', which will characterize fuel beds for a wide variety of ecological and vegetation types, and a set of three 'User's Guides', that will be developed from literature syntheses, one each for sagebrush, pinyon, and juniper-dominated systems. The User's Guides will contain the latest information on how these systems are known to respond to available treatments, and will thus allow managers to make more informed decisions as they consider how to apply treatments under a wide variety of conditions. Information from the current experiment will then be used to craft second editions of the User's Guides toward the end of the study period.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Site selection is underway and is scheduled to be completed by the end of September 2005. Plots and sub-plots are due to be established and ready for sampling by the end of March 2006. Pre-treatment sampling will begin in May 2006.

Memoranda of understanding between each of the 10 research institutions and each respective management entity are currently being developed; each of these will lay out in detail the commitments of both research and management for a 10-year time period.

Work has begun on a network database, the design of which is required to be completed by the end of March 2006. Variables for each of the disciplines are currently being characterized.

We have recently hired a full-time technology transfer specialist, who will be responsible for developing the Fuel's and User's Guides, under the guidance of the SageSTEP technical committee. Work on our website has just begun; this is scheduled to be up and running by the end of September 2005. A poster and a powerpoint presentation that described the project have been developed for general use – the poster has been presented at a sagebrush steppe conference in May and several presentations have already been given with the powerpoint program. Development of a comprehensive study plan is underway, with plans to complete a first working draft by the end of March 2006.

Issues/Concerns; changes in research objectives, methods, or products:

No changes in research objectives or products are expected at this juncture. The pace has been slow in getting the fiscal agreements developed, largely because of the amount of funds involved. The critical stage of site selection is going relatively well, despite having some challenges such as an appeal, some archeological concerns, and a mining claim.

2005 JFSP Principal Investigator Workshop Project Progress Report

Project Title: 1st Fire Behavior and Fuels Conference

Fuels Management—How to Measure Success

JFSP Project No.: 05-S-09

Project Location: Portland, Oregon

Principal Investigators: Patricia Andrews, International Association of Wildland Fire

Contact Information (Phone, e-mail): pandrews@fs.fed.us 406-329-4827

Brief Description of Project:

JFSP is providing partial support for an International Association of Wildland Fire (IAWF) conference, which will be March 27-30, 2006 in Portland, Oregon. The conference will provide an opportunity for investigators to present the results of JFSP-funded projects. March 27 is a day of pre-conference workshops. A proceedings will be published and selected papers will also be printed in a special issue of the International Journal of Wildland Fire.

Status Report (include planned and accomplished science delivery and application efforts, deliverables, and management implications of your research- summarize information with bullet statements):

Conference information is available at <http://www.iawfonline.org>

Abstracts were due on Sept. 30, 2005.

Final papers are due at the meeting, March 30, 2006.

We hope to have the proceedings published by July 2006.

Issues/Concerns; changes in research objectives, methods, or products:

None.

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